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MORTALITY PATTERNS IN THE UNITED STATES SINCE 1960: ESSAYS ON MIGRANT MORTALITY, THE IMPACT OF MEDICARE, AND DEMOGRAPHIC CONSEQUENCES OF CAUSE-SPECIFIC MORTALITY CHANGE

Greg L. Drevenstedt

A Dissertation in Demography and Sociology

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment

of the Requirements for the Degree of Doctor of Philosophy

2001

Samuel H Preston

Professor Samuel H. Preston, Dissertation Supervisor

Herbert L. Smith

Professor Herbert L. Smith, Chair, Graduate Group in Demography

Susan C. Watkins

Professor Susan C. Watkins, Chair, Graduate Group in Sociology

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To Adrienne,

my super atomic gal

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ABSTRACT

MORTALITY PATTERNS IN THE UNITED STATES SINCE 1960: ESSAYS ON MIGRANT MORTALITY, THE IMPACT OF MEDICARE, AND DEMOGRAPHIC CONSEQUENCES OF CAUSE-SPECIFIC MORTALITY CHANGE

Greg L. Drevenstedt

under the supervision of Samuel H. Preston

The three essays which comprise this dissertation examine particular features of mortality patterns in the United States since 1960, with special reference to differences by race and sex. The first essay investigates mortality by region of birth and migration status using data from the National Longitudinal Mortality Study. Contrary to previous studies based on vital statistics data, this research does not find excess mortality among southern-born blacks relative to blacks born elsewhere, but does find higher mortality among southern-born whites. Differences in sociodemographic characteristics between migrants and non-migrants are examined. Educational attainment appears to be the most important factor affecting mortality differentials between U.S.-born migrants and non-migrants. In contrast, foreign-born migrants maintain a substantial mortality advantage over natives despite having less education.

The second essay investigates the impact of the Medicare program on mortality at older ages. When Medicare was introduced on July 1, 1966 health care coverage among older adults increased from around 50 percent to over 95 percent. Many experts suggest that access to high-quality medical care through Medicare has helped older Americans live longer, healthier, and more independent lives. This study uses a relational model of mortality at older ages to simulate conditions that might have prevailed if Medicare had not been introduced. The results suggest that for females, but not for males, a substantial portion of the increase in longevity at older ages since 1966 may be associated with enrollment in Medicare.

The third study uses counterfactual population projections to examine the demographic consequences of cause-specific mortality change since 1960 by race and sex. Deaths between 1960 and 2000 are assigned to 28 exhaustive, mutually exclusive cause groups. Cumulative population gains or losses resulting from changes in mortality are derived by way of difference between race-sex-specific populations projected under observed mortality conditions and populations projected while holding mortality constant for each cause. The absolute and proportionate impact of cause-specific mortality change on the 2000 population is compared for whites and blacks by sex.

Table of Contents

Preface 1

Chapter 1 - Adult Mortality Differences by Region of Birth and Migration Status among White and Black Americans 8

Mortality by Place of Birth 9

Migration Patterns and Selectivity 18

Hypotheses 25

Data 28

Methods 31

Results 32

Conclusion 41

Chapter 2 - The Impact of Medicare on Old-Age Mortality, 1966-1995 52

Overview of Medicare 55

Data and Methods 58

Results 64

Conclusion 71

Chapter 3 - Demographic Consequences of Cause-Specific Mortality Change Since 1960: An Analysis by Race and Sex 87

U.S. Mortality Decline During the 20th Century 89

Avoidable Mortality 96

Classification of Causes of Death 100

Chapter 3 (continued)

Data and Methods 111

Results 119

Conclusion 139

Appendices 194

Appendix to Chapter 2 194

Appendix to Chapter 3 195

Bibliography 198

List of Tables

Table 1.1: Hypothesized Relations between Migrant Selectivity/Advantage and Mortality by Region of Birth and Region of Residence 46

Table 1.2: Hazard Ratios of Death by Region of Birth and Region of Residence, Whites, 1980-1989 47

Table 1.3: Hazard Ratios of Death by Region of Birth and Region of Residence, Blacks, 1980-1989 48

Table 1.4: Differences in Characteristics by Region of Residence and Migration Status, Whites and Blacks, 1980-1989 49

Table 1.5: Hazard Ratios of Death by Region of Residence and Migration Status, Whites, 1980-1989 50

Table 1.6: Hazard Ratios of Death by Region of Residence and Migration Status, Blacks, 1980-1989 51

Table 2.1: Estimates from the Himes Model, Males Ages 45-99, 1960-1995 76

Table 2.2: Estimates from the Himes Model, Females Ages 45-99, 1960-1995 77

Table 2.3: Estimates from the Medicare Model, Males Ages 45-99, 1960-1995 78

Table 2.4: Estimates from the Medicare Model, Females Ages 45-99, 1960-1995 79

Table 2.5: Life Expectancy at Age 65 for Under Observed and Simulated Mortality Conditions, Males and Females, 1966-1995 80

Table 2.5: Projection of the Population Aged 65+ Under Observed and Simulated Mortality Conditions, Males and Females, 1966-1995 81

Table 3.1: Life Expectancy at Birth by Race and Sex, 1900, 1960, and 1998 147

Table 3.2: Cause-Specific Age-Adjusted Death Rates and Percent Change by Race, Sex, and Year, 1960-1997 148

Table 3.3: Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, White Females 149

Table 3.4: Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, White Males 158

Table 3.5: Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, Black Females 167

Table 3.6: Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, Black Males 176

Table 3.7: Cumulative Proportionate Impact of Mortality Change on 2000 Population, Broad Cause Groups by Time Period, Race, and Sex 185

Table 3.8: Cumulative Proportionate Impact of Mortality Change on 2000 Population, Selected Cause Groups by Time Period, Race, and Sex 186

Table A3.1: List of Cause Groups, Including International Classification of Disease Numbers and Comparability Ratios 195

Table A3.2: Comparison of Populations Projected to 2000 under Observed Mortality Conditions with Census Populations 197

List of Figures

Figure 2.1: Level Parameters from Himes and Medicare Models, Males and Females, 1960-1995 82

Figure 2.2: Slope Parameters from Himes and Medicare Models, Males and Females, 1960-1995 83

Figure 2.3: Average Annual Difference in Predicted Death Rates from No Medicare and Medicare Models, Males and Females, 1966-1995 84

Figure 2.4: Life Expectancy at Age 65 Under Observed and Predicted Mortality Conditions, Males and Females, 1966-1995 85

Figure 2.5: Projection of the Population Aged 65+ Based on Mortality Conditions Predicted by Medicare and No Medicare Models, Males and Females, 1960-1995 86

Figure 3.1: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, All Causes Combined 187

Figure 3.2: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Infectious and Parasitic Diseases 188

Figure 3.3: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Cancer 189

Figure 3.4: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Circulatory Diseases 190

Figure 3.5: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, External Causes 191

Figure 3.6: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Smoking and Alcohol-Related Diseases 192

Figure 3.7: Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Medically Avoidable Conditions 193

Figure A2.1: Lexis Diagram Showing Duration of Enrollment in Medicare by Age and Year 194

PREFACE

The bookend events of life–birth and death–are the principal foci of demographic research. Throughout much of the world, the second half of the twentieth century was characterized by precipitous declines in the rates at which both of these events occur, slowing population growth and increasing the average length of life. The pace and magnitude of fertility and mortality decline varied tremendously among different nations, and within nations, among groups differentiated by age, sex, race/ethnicity, and social class. Between 1960 and 2000, the United States was characterized by stable, near-replacement fertility, though trends varied among sociodemographic groups. Following a period of modest declines or stagnation during the 1960s, the secular decline in U.S. mortality resumed its downward course after 1968. Patterns of mortality change over the past four decades have varied by race, sex, and cause of death. This simple, descriptive statement marks the jumping-off point for this dissertation, which examines particular features of U.S. mortality between 1960 and 2000 with special reference to differences by race and sex.

In lieu of the traditional monograph, this dissertation is comprised of three separate studies. The studies are distinguished by the specific research questions they address, the types of data and methods used, and the academic disciplines with which they are naturally aligned. The first study, "Adult Mortality Differences by Region of Birth and Migration Status among White and Black Americans," provides results contrary to those previously published, is the only study that employs individual-level data and analysis, and has the most

sociological orientation. The second study, "The Impact of Medicare on Old-Age Mortality, 1966-1995," addresses a research question directly relevant to health policy, uses both statistical and demographic methods, and is at the intersection of demography of aging, medical sociology, and health services research. The last study, "Demographic Consequences of Cause-Specific Mortality Change Since 1960: An Analysis by Race and Sex," uses simulations to answer a series of hypothetical questions, employs multiple-decrement life table and cohort component projection methods, and is a purely demographic investigation. The remainder of this preface briefly describes each study.

CHAPTER 1 - Adult Mortality Differences by Region of Birth and Migration Status among White and Black Americans

This study responds to previous research showing excess mortality among southern-born African Americans relative to those born in other U.S. regions. Despite epidemiologic evidence marshaled to support this finding, the southern mortality penalty may be an artifact of inconsistencies in reporting birthplace on death certificates and in the census. Following the massive exodus of blacks from the South between 1900 and 1970, many migrants misreported their state of residence as their state of birth in the census for reasons of convenience, employment, or prestige. Such misreporting transfers migrants to the population of natives, reducing the migrant population and enlarging the native population. Since there are no obvious advantages to misreporting a family member's birthplace, this information should be more accurate on death certificates than in the census. Following the conventional practice of combining mortality data from death certificates with population

data from the census to construct death rates may result in mortality for migrants that is artificially high because of deflated denominators (rate=death/population) and mortality for non-migrants that is artificially low because of inflated denominators.

This study minimizes numerator-denominator biases–a classic problem in population-level mortality analyses–by using data from the National Longitudinal Mortality Study (NLMS). The NLMS is an individual-level mortality follow-up survey in which all demographic information is derived from a single source–Current Population Surveys. Individual-level correlates of migration and mortality cannot be accounted for in analyses of death rates based on vital statistics and census data, a problem which is overcome with the NLMS.

Based on a review of previous research, several hypotheses are proposed which relate differences in sociodemographic characteristics between migrants and non-migrants to differences in mortality. The first part of the empirical analysis estimates the association between region of birth and mortality before and after controlling for sociodemographic factors (education, marital status, and residence). The second part examines differences in characteristics between migrants and non-migrants to assess migrant selectivity. The final section of the analysis examines differences in the birthplace-mortality association between migrants and non-migrants.

Consistent with expectations, the results do not show higher mortality for southern-born blacks relative to blacks born in either the Midwest or the Northeast, though southern-born blacks have higher mortality than blacks born in the West or outside the U.S. Whites born in the Midwest, the West, or in another country have significantly lower mortality than

whites born in the South. Educational attainment is the most important sociodemographic factor affecting mortality differentials between U.S.-born migrants and non-migrants: migrants with more education than stayers/natives have lower mortality as well. Consistent with previous research, most foreign-born migrants exhibit a substantial mortality advantage over natives despite having less education.

CHAPTER 2 - The Impact of Medicare on Old-Age Mortality, 1966-1995

This study investigates the impact of the Medicare program on U.S. mortality at older ages. Medicare was created to increase access to and reduce the financial burden of medical care for Americans aged 65 and older. When Medicare began on July 1, 1966 health care coverage among older adults increased from around 50 percent to over 95 percent. Many experts claim that nearly-universal access to high-quality medical care through Medicare helps older Americans live longer, healthier, and more independent lives, yet virtually no empirical research has tested this hypothesis.

A demographic model of mortality at older ages is used to simulate conditions that might have prevailed if Medicare had not been introduced. First, the Himes-Preston-Condran relational model of mortality (Himes, Preston, and Condran 1994) is fit to total U.S. death rates by sex at ages 45-99 from 1960 to 1995. Second, parameters are added to the model to account for duration of enrollment in Medicare at ages 65 and older between 1966 and 1995. Predicted death rates from the modified model more closely approximate observed death rates than those produced by the basic model. Medicare enrollment variables are removed and the remaining Medicare-adjusted parameters are used to simulate mortality

conditions in the absence of Medicare.

Results indicate that most of the increase in longevity and about one-fifth of the growth of the older female population since 1966 is associated with enrollment in Medicare. Based on model predictions, Medicare is responsible for 58 percent (1.54 years) of the increase in life expectancy at age 65 between 1966 and 1995 for females but only 2 percent (0.05 years) of the increase for males. Projections of the older population based on observed and simulated mortality conditions show that 22 percent of the growth in the older female population but only about 2 percent of the growth in the older male population between 1966 and 1996 is attributable to Medicare.

CHAPTER 3 - Demographic Consequences of Cause-Specific Mortality Change Since 1960: An Analysis by Race and Sex

The third study uses simulations to examine the demographic consequences of cause-specific mortality change in the U.S. since 1960. Recent work by White (1999) uses counterfactual population projections to contrast the impact of mortality decline from two leading causes of death: tuberculosis and cardiovascular disease. He finds the U.S. population in 2000 to be 13 percent larger than it would have been if tuberculosis death rates remained at 1900 levels, whereas the gain in population from declines in cardiovascular disease mortality since 1940 has been only 6 percent. These results were obtained by way of difference between the actual U.S. population in 2000 and hypothetical U.S. populations projected to 2000 under conditions holding mortality from tuberculosis and cardiovascular disease constant at 1900 and 1940 levels, respectively.

The work of White is extended by examining a larger number of causes of death and by conducting separate analyses by race and sex. All deaths among U.S. whites and blacks between 1960 and 1996 are assigned to one of twenty-eight cause groups comprised of leading causes of death, medically avoidable conditions, diseases associated with smoking and alcohol consumption, violent causes, and other causes of death. Some cause groups are aggregated into broader categories to examine the impact of mortality change from all causes combined, infectious and parasitic diseases, cancer, circulatory diseases, external causes, smoking and alcohol-related diseases, and medically avoidable conditions. Cumulative population gains or losses resulting from cause-specific mortality change are derived by comparisons between race-sex-specific populations projected under observed mortality conditions and populations projected while holding mortality constant for each cause of death. Population gains are decomposed into prevented deaths and additional births, or, in the case of population losses, additional deaths and unrealized births.

Black females enjoyed the greatest proportionate benefit of declines in U.S. mortality from all causes combined since 1960. Five percent of black females alive in 2000 owed their existence or survival to these declines, whereas the proportionate addition to the U.S. population in 2000 was 3.84 percent for white males, 3.48 percent for white females, and 3.02 percent for black males. The absolute impact of mortality decline since 1960 from all causes combined was the addition of 8.28 million whites and 1.43 million blacks to the 2000 population. Enormous population gains from declines in circulatory disease and medically avoidable mortality were partially offset by population losses from increases in infectious and parasitic disease (especially HIV infection) and cancer (especially lung cancer) mortality.

Each of these studies documents mortality patterns that differ by race and/or sex. The first study finds that regional patterns of mortality are not the same for white and black Americans. In the second study, Medicare is associated with lower mortality among women but not men. The last study shows that black females benefitted most from overall mortality declines since 1960. Many factors contribute to these mortality differentials, most of which are social in origin. Findings are placed within the context of previous research, and, whenever possible, explanations are drawn from the relevant literature. However, as is common practice in demography, this dissertation hedges against excessive speculation and places greater emphasis on careful description.

CHAPTER 1

Adult Mortality Differences by Region of Birth and Migration Status among White and Black Americans

A growing literature postulates the influence of macro-level social and economic conditions–e.g., the concentration of poverty, social disorganization, and racial segregation–on health. These studies demonstrate an independent association between macro-level conditions and health outcomes after controlling for individual-level characteristics (Anderson et al. 1996; Haan, Kaplan, and Camacho 1987; Geronimus et al. 1996, 1999; Harburg et al. 1973; LeClere, Rogers, and Peters 1997; McCord and Freeman 1990; Robert 1998). Yet most research on the social determinants of health has a micro-level orientation and examines the association between individual-level, contemporary conditions and current health. Adult health is best conceptualized as the product of a lifetime of exposures, behaviors, and experiences (House et al. 1990, 1994; Kington et al. 1998). For example, epidemiologic and demographic evidence shows that disadvantaged or unhealthy conditions during childhood elevate risks of morbidity and mortality in adulthood (Elo and Preston 1992).

This chapter investigates the association between early and later life conditions and adult mortality. It begins with a review of relevant literature on mortality by place of birth, internal migration, and migrant selectivity. Several hypotheses are proposed and tested which relate differences in sociodemographic characteristics between migrants and non-

migrants to mortality. The empirical analyses are based on the National Longitudinal Mortality Study (NLMS), an individual-level mortality follow-up survey which avoids biases inherent in migrant mortality studies that use aggregate data (Monk and Warshauser 1978). The first part of the analysis examines the relative influence of early and later life conditions on adult mortality using region of birth to proxy macro-level social, economic, and environmental circumstances at young ages. The second part of the analysis assesses migrant selectivity by comparing differences in sociodemographic characteristics between migrants and non-migrants. Finally, the association between early life conditions and mortality is examined by migration status before and after adjusting for sociodemographic selectivity. African Americans and whites are analyzed separately because these two segments of the U.S. population have experienced distinct patterns of internal migration and mortality.

MORTALITY BY PLACE OF BIRTH

Although many linkages between early life conditions and adult mortality have been found (for reviews, see Elo and Preston 1992; Mosley and Gray 1993), most adult mortality studies are confined to investigations of associations between current status variables and subsequent mortality because they lack information about childhood circumstances. Empirical studies of the association between early life conditions and mortality are usually based on commonly collected indicators such as date or place of birth (Elo and Preston, 1992). Date of birth can be used to link individuals to the experiences of particular birth cohorts, whereas place of birth is used as a proxy for the ecological characteristics of the area where a person grew up. Elo and Preston (1992:198) suggest that inasmuch as

"epidemiologic and social environments vary across places in the same country, it is reasonable to expect those variations to be reflected in adult mortality rates among persons growing up in different areas." That is, geographic variations in economic, social, and environmental conditions translate into differential rates of morbidity and mortality for people born in different areas (Bentham 1988). Indeed, macro-level factors "represent the socioeconomic, political, health service, cultural, and physical environments in which health and mortality outcomes are shaped" (Hummer, Rogers, and Eberstein 1998:569).

Because migration alters the macro-level conditions to which individuals are exposed, mortality risks among migrants may fall between those of the origin and destination populations. Previous research has found lower mortality among migrants relative to the population at origin (positive selection) but higher mortality relative to the population at destination (disadvantage; Marmot, Adelstein, and Bulusu 1984). On the other hand, origin effects may dominate destination effects, with health risks among migrants remaining similar to those in the origin population rather than converging with those in the destination population (Lanska and Peterson 1995). Individual factors also affect health and mortality differences between migrants and non-migrants. Migration involves exposure to unfamiliar living conditions, new occupational hazards, lifestyle changes, and the stress of dislocation, adaptation, and alienation, all of which may negatively affect health. However, favorable attributes among migrants, such as being younger, better educated, and more highly-motivated than non-migrants, may help them counteract deleterious effects of the migration experience (Hull 1979).

In a well-designed study using Finnish data, Valkonen (1987) analyzed death records

for 1971-75 linked to 1970 census records. Restricting his analysis to males aged 35-64 in the census, Valkonen investigated variation in ischemic heart disease (IHD) mortality by region of birth and by region of residence, while controlling for various sociodemographic characteristics. Region of birth had a stronger association with IHD mortality than region of residence. When controls were added for socioeconomic status the regional effects were not diminished, thus differences in current life conditions did not account the variation in IHD mortality by region of birth and by region of residence.

In Valkonen's study, region of birth served as a proxy for early life conditions while region of residence and socioeconomic status measured contemporary conditions. The relative magnitudes of associations between early life and current life conditions and mortality yield support for different hypotheses. If mortality for persons who live in an area other than their region of birth is closer to mortality patterns in their region of birth than in their region of residence, then the origin effects/early life conditions hypothesis would be supported. On the other hand, if mortality more closely resembles one's region of residence rather than one's region of birth, then the destination effects/current life conditions hypothesis would be supported. The stronger association between region of birth and mortality in Valkonen's study is consistent with the origin effects/early life conditions hypothesis.

Perhaps the most detailed test of the early life conditions hypothesis is a study by Preston, Hill, and Drevenstedt (1998). This study is based on death certificates for native-born African Americans who died at ages 85+ linked to childhood census manuscripts from 1900 or 1910 (see Preston, Hill, and Drevenstedt 1998 for more details). The study employs

a cross-sectional case-control design, where linked individuals are matched to five African American control subjects of the same reported age from the public-use microdata sample (PUMS). Logistic regression is used to examine associations between early life conditions and with survival to ages 85+, with exponentiated regression coefficients corresponding to relative survival probabilities for various characteristics. Residential characteristics that positively predict survival to ages 85+ include living on a farm and homeownership, but living in a densely populated area is negatively associated with longevity. Marital stability among parents, parental literacy, farm occupation among fathers, a below-average number of sibling deaths, being female, and the ability to read are also positively associated with survival to ages 85+. A follow-up study for whites finds similar results (Hill, Preston, Rosenwaike, and Dunagan 2000). In sum, the results of Valkonen (1987) and Preston and colleagues (Preston, Hill, and Drevenstedt 1998; Hill, Preston, Rosenwaike, and Dunagan 2000) demonstrate that childhood conditions are important determinants of mortality risks in later life.

Other studies have examined differences in mortality by region of birth and migration status within the U.S. Aimed at assessing the impact of the Great Migration on population health status, most of these studies focus only African Americans. Whether examining the U.S. as a whole or specific geographic areas, these studies typically construct mortality rates by relating deaths from vital statistics to population counts from the census. One of the earliest macro-level studies of black migrant mortality compares state-level death rates by place of birth among black residents of Ohio during the period 1960-67 (Mancuso and Redmond 1975). The study finds higher all-cause and cardiovascular disease mortality for

southern-born blacks relative to Ohio-born blacks, which the authors attribute to a carry-over of higher risk from the more socioeconomically-deprived South.

A more recent study of migrant mortality among African Americans relates U.S. deaths from vital statistics for 1979-81 to population from the 1980 census (Greenberg and Schneider 1992). Results for U.S.-born blacks show that death rates were highest for the southern-born and lowest for the western-born regardless of region of death. Death rates for migrants were closer to their region of birth than their region of residence, which supports the origin effects/early life conditions hypothesis. Interestingly, foreign-born blacks had the highest or second highest age-adjusted death rates among those who died in the Midwest, the South, and the West, which is contrary to other research showing that the foreign-born, on average, have lower mortality than the native-born (Elo and Preston 1996; Hummer, Rogers, Nam, and LeClere 1999). Subsequent studies based on mortality data for 1979-91 find excessive mortality among southern-born blacks for various types of cancer (Greenberg and Schneider 1995), circulatory diseases (Schneider, Greenberg, and Lu 1997a), and diabetes mellitus (Schneider, Greenberg, and Lu 1997b).

Aggregate mortality data for New York City (NYC) covering the period 1988-92 show substantially higher mortality for southern-born blacks relative to blacks and whites born in the Northeast and blacks born in the Caribbean (Fang, Madhavan, and Alderman 1996). Sex-specific comparisons for three age groups (25-44, 45-64, and 65 and above) show that southern-born blacks had the highest death rates for all causes and various cardiovascular causes in all but two cases. Due to the consistency and magnitude of these differences, the authors conclude that black-white differences in mortality among NYC

residents "are largely accounted for by mortality among Southern-born blacks" (Fang, Madhavan, and Alderman 1996:1550). A more comprehensive comparison of aggregate mortality by race, region of birth, and cause of death for white and black NYC residents for the same period finds that the mortality penalty associated with southern birth is primarily an African-American phenomenon (Fang, Madhavan, and Alderman 1997). Southern-born black males, regardless of age, have significantly higher death rates than black males born in other regions for all causes and seven leading causes (AIDS, cancer, diabetes, heart disease, stroke, cirrhosis, and homicide). The southern disadvantage is consistent across causes for older black females, though there are some exceptions at younger ages. Among whites, there is a significant southern disadvantage at older ages, but at younger ages mortality is highest for those born in the Northeast.

The macro-level studies reviewed above consistently report a substantial mortality disadvantage among southern-born African Americans, but two important data limitations cast a shadow of doubt over these findings. First, all of the studies use aggregate mortality data compiled from two sources–deaths from vital statistics and population counts from the census. Mortality rates are particularly sensitive to inconsistencies in demographic information between different data sources since deaths in the numerator of the rate will not accurately reflect the population at risk in the denominator (Elo and Preston 1994; Kitagawa and Hauser 1973; Rogers, Carrigan, and Kovar 1997). In an analysis of cancer mortality among migrants, Monk and Warshauser (1978) find that southern-born black males who migrated to North often reported their state of residence as their state of birth in the census for reasons of convenience, employment, or social prestige. If the number of natives are

overreported and the number of migrants are underreported in the census, then denominators for death rates will be inflated for natives and deflated for migrants, resulting in artificially high death rates for migrants and artificially low death rates for natives. This type of misreporting bias could result in an erroneously large mortality disadvantage for migrants, especially for a highly mobile population such as African Americans. Typically, micro-level studies of morbidity and mortality are not subject to numerator-denominator inconsistencies because demographic information comes from a single source such as a survey.

Second, macro-level studies which attribute excess mortality among the southern-born to lower socioeconomic status, poorer dietary habits, and worse health behaviors in the South are unable to control for individual-level differences in socioeconomic or health-related factors between migrants and non-migrants. On the other hand, studies that employ individual-level data are able to control for characteristics which confound the association between migration and mortality.

In addition to their state-level mortality analysis, Mancuso and Redmond (1975) report results from a cohort study of nearly eight-thousand black steelworkers in Allegheny County, Pennsylvania between 1953 and 1966. In contrast to the findings based on aggregate data, results of the cohort study show that migrant steelworkers, nearly three-quarters of whom were born in the South, had approximately the same risk of heart disease mortality as Pennsylvania-born steelworkers. The authors speculate that pre-employment medical screening and the physical demands of working in a steel mill may have selected out southern-born migrants in poor health, but these hypotheses could not be tested.

In addition to the data limitations described above, historical studies of regional

mortality patterns suggest that southern blacks, at least those born in the early decades of the twentieth century, had less exposure to unhealthy conditions than blacks born in other regions. For example, estimates of child mortality in the U.S. based on data from the 1900 and 1910 censuses show that blacks residing in the South had lower mortality than blacks elsewhere in the U.S. regardless of urban/rural residence (Ewbank 1987; Preston and Haines 1991). There was not a consistent southern advantage among whites. These studies attribute the mortality disadvantage among northern blacks to higher urbanization relative to southern blacks. Black children living in the North suffered greater excess mortality in medium-sized (5,000-24,999 inhabitants) cities than their counterparts in the South, although black children living in the ten largest U.S. (all but one of which were outside the South) had lower mortality than black children living in smaller cities because of earlier introduction of clean water, sewage systems, and other public health measures. The urban disadvantage around 1900 "suggests that cities' efficiency in spreading communicable diseases more than offset any political and economic advantages that they may have presented for instituting health-related public works and services" (Preston and Haines 1991:97).

Mortality declined steadily during the early 1900s as public health infrastructure expanded and child-rearing practices and the use of health services improved. Comparisons of life expectancy at birth in 1920 and in 1939-40 in New York, North Carolina, and South Carolina reveal higher mortality in New York for blacks and whites in 1920 relative to the southern states, whereas New York achieved a slight advantage in life expectancy by 1939-40 (Ewbank 1987). The more rapid declines in mortality between 1920 and 1940 "among blacks living in northern cities not only eliminated the excessive mortality of northern blacks,

but reversed the differential" (Ewbank 1987:126). In other words, until around 1940, southern blacks had a mortality advantage relative to blacks in other U.S. regions because of they were more heavily concentrated in rural areas which had more benign disease environments. Since greater exposure to infectious diseases such as tuberculosis, hepatitis B, acute rheumatic fever, and various respiratory infections in childhood can increase risks of adult mortality (Elo and Preston 1992), blacks born in the South during the early decades of this century should have a mortality advantage relative to blacks born in urban areas in the Midwest and the Northeast.

A recent study by Kington et al. (1998) provides some evidence for better health among older southern-born blacks relative to blacks born in other regions. Kington and colleagues examine differences in functional status (activity limitation, help with personal care, restricted activity days, and bed days) and self-reported health by migration status for older African Americans and whites using data from the 1994 National Health Interview Survey. Controlling for differences in marital status, education, income, and central city residence, the authors find that native southern blacks need more help with personal care and report poorer overall health than native northern blacks. Southern-born blacks who migrated to the North were positively selected on health, with migrants reporting significantly fewer activity limitations, less need for help with personal care, and better overall health than southern stayers. Most notably, southern-born black migrants report better functional status and general health than northern natives, which suggests a migrant health advantage even after controlling for sociodemographic factors (only the difference in activity limitations was statistically significant). These results stand in stark contrast to those of migrant mortality

studies reviewed above, which paint a bleak picture of mortality for southern-born migrants. The migrant advantage, however, is limited to African Americans only; southern-born whites who migrated to the North reported significantly worse functional status and overall health than native northern whites.

Although they were unable to test such a hypothesis, Kington and colleagues (1998) argue that better health among southern-born black migrants may be reconciled with higher mortality among southern-born blacks if selective survival results in a relatively healthier and hardier migrant population. There are two problems with such an explanation. First, as described above, the findings of migrant mortality studies based on aggregate data may be sensitive to numerator-denominator bias and an inability to control for confounding factors. Second, previous studies which examine the effects of early life conditions on adult mortality find that risks of morbidity and mortality are positively correlated over the life span (Elo and Preston 1992; Preston, Hill, and Drevenstedt 1998; Hill, Preston, Rosenwaike, and Dunagan 2000). In other words, deleterious social, economic, and environmental conditions which increase risks of morbidity and mortality during childhood tend to affect adult health in a similar way, resulting in a less healthy population of adult survivors. Migrants and non-migrants differ not only in duration of exposure to certain macro-level conditions, but also in terms of other sociodemographic characteristics.

MIGRATION PATTERNS AND SELECTIVITY

A feature distinguishing white and black Americans during the twentieth century is the massive redistribution of the African American population referred to as the "Great

Migration" (Farley and Allen 1987; Kington et al. 1998). Throughout the era of slavery and Reconstruction, blacks were overwhelmingly concentrated in the U.S. South. The transformation of the American economy away from agriculture and towards manufacturing was accompanied by a large-scale shift of the population from rural areas to urban centers (Farley 1996), with the most dramatic consequences for African Americans. Between 1900 and 1970, the share of the black population residing in the South declined steadily from 90 percent to 53 percent, while those living in urban areas increased from 20 percent to over 80 percent. In contrast, the regional distribution of whites was generally more uniform and stable during this period and urbanization was more gradual and less complete (U.S. Bureau of the Census 1975).[1]

Urbanization and inter-regional migration were driven primarily by economic forces, such as the higher demand for labor and better wages available in northern industrial cities. In addition to economic motivations, intense discrimination and racial violence served as powerful stimulants for the African American exodus from the South (Dennis 1989; Farley and Allen 1987; Taeuber and Taeuber 1965). For example, between 1910 and 1930 black migration out of the South was heaviest from counties where the greatest number of lynchings occurred (Tolnay and Beck 1992). However, racial intolerance was not confined only to the South. Hostility towards black migrants in the North sparked numerous riots, and most migrants were forced to settle in densely-populated, segregated neighborhoods where living conditions were miserable (Massey and Denton 1993). Although some authors

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1 For more detailed descriptions of the Great Migration, see Dennis (1989), Farley and Allen (1987), Fligstein (1981), Johnson and Campbell (1981), Lemann (1991), and Marks (1989).

contend that exposure to hazardous living and working conditions (McBride 1991; Williams 1996) and cultural disorganization (Herd 1985) resulted in higher morbidity and mortality among migrants, other evidence suggests that migrants enjoyed certain advantages over non-migrants.

Sociological interest in migration focuses on characteristics which distinguish migrants from non-migrants (Cadwallader 1992; Shaw 1975). In his classic theory of migration, Lee (1966) develops hypotheses about differences between migrants and non-migrants on the basis of factors which influence the process of migration. As inducements to migration, positive attributes of origin and destination areas are referred to 'pull' factors, whereas negative attributes are considered 'push' factors. Other factors which influence migration include intervening obstacles between origin and destination and personal attributes of migrants. Lee hypothesizes that, because individuals respond differently to push and pull factors, vary in their capacities to overcome impediments to residential mobility, and are heterogeneous in terms of personal attributes, migration is a selective process.

Elaborations on the basic selectivity hypothesis depend on which factor is the driving force behind migration. For instance, if migration is a response to favorable conditions at destination then migrants tend to be positively selected from the origin population, with the degree of positive selectivity increasing with the difficulty of intervening obstacles.[2] One

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2 To avoid confusion when comparing migrants and non-migrants, the following terminology is used (Bouvier, Macisco and Zarate 1976). Members of the sedentary population at the place of origin are referred to as 'stayers,' while lifetime residents at the place of destination are 'natives.' The term 'selectivity' is used in comparisons of migrants and stayers at origin, where positive selectivity indicates more favorable characteristics among migrants and negative selectivity indicates less favorable characteristics among migrants (Lee 1966). When comparing characteristics of migrants versus natives, more favorable characteristics of migrants are an 'advantage' and less favorable characteristics of migrants are a 'disadvantage.'

would expect that migrants who relocate in search of better opportunities elsewhere to be more highly motivated and have greater access to social and economic resources than those who remain sedentary. On the other hand, migrants who move because of adverse conditions at origin tend to be negatively selected since disadvantaged groups may be less able to ameliorate unfavorable circumstances, and thus may feel more compelled to migrate, than more advantaged groups. Since push and pull factors often operate simultaneously, migrant selectivity is usually bimodal, with the migrant population jointly comprised of positively and negatively selected individuals. Finally, while the preceding hypotheses refer to differences between migrants and the population at origin, Lee further contends that characteristics of migrants tend to be intermediate between characteristics of the population at origin and those of the population at destination.

Since the promise of greater opportunities in other areas was an overarching motivation for inter-regional migration during the twentieth century, Lee's theory suggests that most migrants were positively selected from their origin populations. If characteristics of migrants do indeed fall between those of the origin and destination populations, then most migrants were disadvantaged relative to natives. The push factor of racial oppression in the South would have negatively selected blacks from the origin population if disadvantaged blacks were less able to mitigate the forces of racism than their more advantaged counterparts. However, Lee (1966:56) argues that if adverse conditions at origin are "overwhelming to entire population groups, [migrants] may not be selected at all," thus the pervasive atmosphere of racism in the South may have induced African Americans to emigrate regardless of their personal attributes. Thus, white migrants and black migrants

from the North[3] should exhibit positive selectivity relative to stayers, whereas black migrants from the South should exhibit little or no selectivity relative to stayers.

Social selectivity among migrants is typically measured using census data to compare differences between migrants and non-migrants in terms of education, labor force participation, earnings, occupation, marital status, etc. Census data for the period 1880-1990 show that southern-born whites and blacks who migrated to the North had significantly higher levels of education than southern stayers but less education than northern natives (Tolnay 1998). The positive educational selectivity of southern-born migrants relative to stayers exceeded their educational disadvantage relative to northern natives, and the disparity in education between migrants and non-migrants was smaller for whites than for blacks. Nonetheless, differences in educational attainment between migrants and non-migrants attenuated over the course of the twentieth century as overall regional differences in educational attainment declined.

Data for males from the 1980 census show that, except for slightly higher unemployment, southern-born black migrants were positively selected relative to southern stayers: they had more years of schooling, higher status occupations, higher earnings, and a greater likelihood of marriage (Farley and Allen 1987). Southern-born white migrants were positively selected for socioeconomic status, but were less likely to be married. Regardless

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3 "North" refers to all non-South regions as defined by the Census Bureau (Northeast, Midwest, and West). Since the pattern of inter-regional migration among African Americans during the twentieth century was overwhelmingly characterized by migration into and out of the South, this convention has been used by other authors (Farley and Allen 1987; Kington et al. 1998; Long and Heltman 1975; Tolnay 1997, 1998; Tolnay and Crowder 1999; Tolnay, Crowder, and Adelman 2000). Although grouping all non-southern regions ignores migration and obscures differences between these regions, the North-South regional dichotomization is used throughout most of this chapter.

of race, migrants to the South were positively selected relative to northern stayers. Whereas the characteristics of migrants were clearly more favorable than those of stayers, differences between migrants and natives at destination varied by duration of time since migration. Southern-born blacks who resided in the North for more than five years–'long-term migrants'– were less educated and held less prestigious jobs than northern natives, but they were more likely to be employed, enjoyed higher earnings, and were more likely to be married. Southern-born blacks who had been living in the North for less than five years–'recent migrants'–were advantaged relative to northern natives on all traits except earnings. In contrast to blacks, whites who were long-term migrants from the South exhibited no advantages over native northerners, and recent migrants were advantaged only in terms of education, occupation, and welfare recipiency. Northern-born black and white males who migrated to the South had much more favorable characteristics than their native southern counterparts, although whites who recently migrated to the South lagged behind natives in terms of employment, earnings, and marriage.

Other studies have documented migrant selectivity/advantage in family structure and residential patterns. Census data show that black southern-born migrants living in northern central cities have more traditional family patterns–more children live with two parents, more married women live with spouses, and fewer mothers are single–than black northern natives, while the opposite is true for whites from the South (Tolnay 1997). The southern migrant advantage in family stability among blacks is upheld even after controlling for metropolitan-level poverty, male underemployment, female headship, and welfare prevalence, although the "destabilizing structural and cultural influences of northern cities" tend to diminish the

migrant advantage over time (Tolnay and Crowder 1999:109). Duration of residence in the North also reduces the southern migrant advantage in residential settlement. Southern-born blacks who have lived in the North for less than five years are less likely to live in neighborhoods characterized by segregation, poverty, and family instability than native northern blacks, but long-term black migrants from the South are the most likely to live in unfavorable neighborhoods (Tolnay, Crowder, and Adelman 2000).

Several conclusions may be drawn from the results of these studies. First, inter-regional migrants tend to be positively selected from the origin population regardless of race or region of birth. With few exceptions, whites and blacks who migrate to another region have a more favorable sociodemographic profile than those who stay behind. Second, the migrant advantage relative to the native population at destination varies by race, region of birth, and duration of time since migration: black migrants exhibit a more consistent advantage over natives than white migrants; northern-born migrants are consistently advantaged relative to southern natives, but among southern-born migrants only blacks are advantaged relative to northern natives; and recent migrants are more advantaged than long-term migrants. Overall, the evidence suggests that migrants often have more favorable characteristics than either stayers or natives, which does not accord with Lee's hypothesis of migrant traits being intermediate between those of the origin and destination populations. One objective of this study is to determine whether positive selectivity/advantage with respect to sociodemographic factors contributes to lower mortality for migrants relative to non-migrants.

HYPOTHESES

The evidence reviewed above clearly shows that migrants differ from non-migrants with respect to both social conditions and health. A primary interest of this study is the link between the two. At the simplest level, since social conditions are correlated with health (Link and Phelan 1995), favorable conditions among migrants should translate into lower mortality relative to non-migrants. However, other factors also affect the association between migration and mortality. Because migrants may be distinguished from non-migrants for a wide variety of characteristics, the concept of migrant selectivity/advantage can be separated into two components: observable factors and unobservable factors. In terms of observable factors, this study uses education, marital status, and central city residence to assess selectivity/advantage between migrants and non-migrants.[4] Table 1.1 presents a typology of hypothesized relations between migrant selectivity/advantage and mortality. The table is organized as a simple cross-tabulation of region of birth and region of residence, with birthplace on the vertical axis (North, South, and foreign-born) and residence on the horizontal axis (North and South); all members of the sample may be classified into one of the six categories.

The following hypotheses are proposed for the four migrant categories in Table 1.1.

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4 Migrant selectivity/advantage is examined according to these three variables for the following reasons. Education is a robust, stable feature of socioeconomic status which influences occupational status, income, and ability to gather and process information, and it exhibits a strong inverse association with health and mortality (Hummer, Rogers, and Eberstein 1998). Marital status, which reflects social support and family stability, is also a determinant of mortality, with married persons having significantly lower mortality than the unmarried (Rogers 1995; Sorlie, Backlund, and Keller 1995). Finally, central city residence serves as a proxy for exposure to certain health risks and availability of resources within the surrounding community. A number of studies have found that residence in central cities is associated with higher mortality, especially among African Americans (Elo and Preston 1996; Geronimus et al. 1996, 1999; McCord and Freeman 1990).

First, it is hypothesized that U.S.-born migrants who leave their region of birth will have lower mortality than those who remain behind (stayers) if selectivity is positive. In other words, if migrants have a more favorable sociodemographic profile than stayers (i.e., more education, married, non-central city residence), then such differences should translate into lower mortality for migrants. On the other hand, if migrants have less favorable attributes than stayers (i.e., less education, unmarried, central city residence), then migrants should experience higher rates of mortality than the sedentary population. Second, using similar logic, it is hypothesized that U.S.-born migrants will have lower mortality than natives in their region of destination if migrants are advantaged in terms of sociodemographic characteristics relative to the native population. Conversely, migrants who are disadvantaged relative to natives should experience higher mortality than natives. Migrants may be positively selected/advantaged for one or more characteristics while being negatively selected for others. Of all individual characteristics considered here, educational attainment should be the dominant factor in the comparisons because of its particularly robust association with mortality. Third, based on research which shows that the foreign-born have lower odds of dying than the native-born even after controlling for age, sex, education, income, and marital status (Elo and Preston 1996; Hummer et al. 1999), it is hypothesized that foreign-born migrants will experience lower mortality than natives of their region of residence irrespective of differences in sociodemographic characteristics.

Unobserved factors for which migrants may also be selected/advantaged include all unmeasured individual-level and macro-level factors associated with birthplace or area of residence. Region of birth serves as a proxy for unobserved early life factors. According to

U.S. migrant mortality studies, one might expect levels of mortality in the South to be considerably higher than in other regions, particularly among African Americans. However, studies of regional differences in mortality yield mixed results. Based on matched census and death records for 1960, comparisons of mortality ratios by race and sex for each U.S. region[5] relative to the West reveal a consistent ranking of regions by mortality, with the lowest mortality in the West, followed by the Midwest, the South, and the Northeast (Kitagawa and Hauser 1973). More recent data from the NLMS, covering the period 1979-85, suggests different regional rankings by race and sex. For whites, the West has the lowest mortality, followed by the Midwest, with the remaining two regions ranked Northeast-South for males and South-Northeast for females. For blacks, the lowest mortality is in the Northeast, followed by the West, the South, and the Midwest (Rogot, Sorlie, Johnson, and Schmitt 1992). Overall, these comparisons do not support the notion that the South has consistently higher mortality than other U.S. regions. However, using the 1979-85 data from the NLMS, a mortality ratio for the non-South, or "North," can be calculated by summing actual and expected deaths for the Northeast, Midwest, and West.[6] Relative to the North, mortality in the South is 3.4 percent higher for whites males, 1.6 percent higher for white females, 4.3 percent higher for black males, and 1.4 percent higher for black females. On the basis of this rather crude grouping it is expected that, all else being equal, mortality will be higher among the southern-born. This final hypothesis is shown in Table 1.1 in the cell

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5 Mortality ratios are based on the ratio of actual to expected deaths in 1960, where expected deaths are obtained by multiplying age-specific death rates for the total U.S. by the age composition of each sex-region subgroup for whites and blacks.

6 This ratio is simply a weighted average of the ratio of actual to expected deaths for the three regions.

for southern stayers/natives.

DATA

The National Longitudinal Mortality Study (NLMS) is a nationally representative mortality follow-up study directed by the National Heart, Lung, and Blood Institute containing over 1.3 million individual records derived from twelve Current Population Surveys (CPS) conducted between 1973 and 1985 and from the 1980 census (see Rogot, Sorlie, Johnson, and Schmitt 1992 for a more complete description of the NLMS).[7] This analysis is based on a subset of the NLMS sample for which information on place of birth was collected, which corresponds to three CPS cohorts surveyed in April, August, and December of 1980. Of the 545,009 records in the NLMS database for these three cohorts, the sample is further restricted to 290,221 subjects. Since this study focuses on adult mortality, the sample is limited to respondents aged 25-89. The study sample is comprised of 262,557 non-Hispanic Whites and 26,117 non-Hispanic Blacks, with individuals for whom Hispanic origin information was missing coded as non-Hispanic.

All sociodemographic information for members of the sample was taken from the CPS. Certain respondent characteristics (e.g., Social Security number, first and last name, sex, etc.) were used to match NLMS records to the National Death Index (NDI), a computerized index containing information for all death certificates in the U.S. since 1979 (Rogot, Sorlie, and Johnson 1986). If a respondent died between the baseline survey date

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7 This study uses data from the restricted-use version of the NLMS, which includes information on place of residence at baseline not found in the public-use version. Eric Backlund of the U.S. Census Bureau is gratefully acknowledged for providing the data analysis necessary for this study.

and the end of 1989 and was successfully matched to the NDI, then date and time of death, underlying cause of death, and other information from the death certificate were added to the individual's record in the NLMS database; no sociodemographic information listed on the death certificate was added to the NLMS record. Recording errors in some NLMS files resulted in some deaths being missed during attempts to match records to the NDI, with ascertainment loss of about 5 percent (Rogot, Sorlie, Johnson, and Schmitt 1992).

The geographic distribution of the African American population, in terms of birthplace and residence, is heavily skewed towards the South. Over 55 percent of all blacks in the sample reside in the South, with 78 percent born in the South. Among black migrants born in the U.S., 93 percent moved from the South to another region. In the first part of the analysis on mortality differences by region of birth and region of residence, the South is compared to other census regions separately–the Northeast, the Midwest, and the West. However, because most blacks were born and/or live in the South, the analyses of social selectivity/advantage and mortality differences by migration status compare the South to all other regions combined, an area referred to as the North (see footnote 3).

Region of birth proxies, albeit crudely, macro-level social and epidemiological conditions during childhood. Conditions in adulthood are measured at both the micro-level (educational attainment, marital status, and migration status) and the macro-level (urban/metropolitan residence and region of residence). Migration status is determined by comparing region of birth and region of residence in the baseline survey: if the respondents reside in their region of birth they are classified as non-migrants and if they reside in a region other than their region of birth they are classified as migrants. Region of residence at

baseline is assumed to be region of residence at time of death. Since no demographic information on the death certificate was added to the NLMS record, migration after baseline cannot be determined. Furthermore, since the NLMS does not contain information on age at or time of migration, duration of exposure to conditions at origin or destination cannot be assessed. The examination of social selectivity/advantage compares differences in mean years of schooling, percent married, and percent living in central city/urban areas between migrants and non-migrants. The multivariate analyses focus on the associations with region of birth, region of residence, and migration status before and after adjustment for sociodemographic characteristics. The results for the sociodemographic variables themselves are not presented, although they are occasionally referred to in the text.

In the multivariate models that adjust for marital status, educational attainment, and metropolitan/urban residence, these variables are operationalized in the following way. Marital status includes categories for married (referent), divorced/separated, widowed, and never married. Educational attainment classifies years of schooling completed into five categories: 0-8, 9-11, 12 (referent), 13-15, and 16+. Metropolitan status identifies type of residence with respect to Standard Metropolitan Statistical Area (SMSA) boundaries, and urban status identifies individuals living in areas with 2,500 or more inhabitants. These two measures are combined in a joint dummy variable with the following categories: metropolitan/central city and urban; metropolitan/not central city and urban; metropolitan/not central city and rural; and non-metropolitan and rural (referent).

METHODS

Analysis of variance (ANOVA) and logistic regression are used to assess sociodemographic selectivity/advantage. Differences in mean educational attainment between migrants and non-migrants are tested using ANOVA, while differences in marital status (married/not married) and central city residence (in central city/not in central city) are tested using logistic regression.

Proportional hazards regression (Cox 1972) is employed to model the risk of death during the follow-up period while adjusting for covariates fixed at baseline. The risk, or hazard, of death for individual i at time t, $h_i(t)$, is modeled as the product of an unspecified baseline hazard function, $\lambda_0(t)$, and a multiplicative function of k fixed covariates: $h_i(t) = \lambda_0(t)\exp\{\beta_1 x_{i1} + ... + \beta_k x_{ik}\}$, which compares the characteristics of decedents with those of survivors. Cox proportional hazards regression is ideally suited for this analysis since it takes advantage of information on the timing of deaths during the follow-up period while not requiring a particular probability distribution for survival times to be specified (Allison 1995). The NLMS contains a variable indicating the number of days to death from baseline, with the baseline date varying among different CPS cohorts. A death indicator variable distinguishes which members of the sample died during follow-up and those that were censored (i.e., those not matched to the NDI by the end the follow-up period). All analyses were conducted using SAS statistical software, Version 6.12 (SAS Institute, Inc. 1989).

The multivariate analysis in this paper proceeds in two parts, with results reported separately for whites and blacks. First, the associations between macro-level conditions in early and later life and adult mortality are examined. A series of models estimate the

independent and joint associations between region of birth and region of residence and mortality before and after introducing controls for sociodemographic factors (educational attainment, marital status, and metropolitan/urban status). Two models estimate the association between region of birth and mortality, one which controls only for age and sex and one that adjusts for other sociodemographic factors. Analogous pairs of models are used to estimate the independent association of region of residence and the simultaneous associations of region of birth and region of residence with mortality before and after adjustment. In a separate analysis, relative mortality is estimated for migrants and non-migrants residing in the South and North (natives/stayers, U.S. migrant into region, and foreign-born migrant into region), also with and without controls for education, marital status, and urban/metropolitan residence.

RESULTS

Mortality by Region of Birth and Region of Residence

The results of this analysis are shown in Table 1.2 for whites and Table 1.3 for blacks.[8] The first two models in each table estimate the association between mortality and region of birth before and after adjusting for educational attainment, marital status, and metropolitan/urban residence, with southern-born as the reference category. The unadjusted birthplace model for whites in Table 1.2 shows that the southern-born have mortality 7.6

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8 The results of the multivariate analyses in Tables 1.2, 1.3, 1.5, and 1.6 are reported in the form of hazard ratios. A hazard ratio is obtained by exponentiating an estimated Cox regression coefficient (e^b), and it indicates the factor difference between the baseline hazard of death and the hazard of death associated with a particular characteristic. Hazard ratios greater than 1.0 indicate higher mortality, below 1.0 indicate lower mortality, and close to or equal 1.0 suggest little or no difference.

percent ([1.000-0.924]×100) higher than the midwestern-born, 15.2 percent higher than the western-born, and 16.2 percent higher than the foreign-born, but there is no difference in mortality between whites born in the Northeast versus the South. Adjustment for sociodemographic factors diminishes the mortality advantage of those born in the Midwest and the West, but increases the advantage for the foreign-born. Interestingly, the unadjusted region of birth model for blacks in Table 1.3 does not reveal any significant differences in mortality between blacks born in the South and blacks born in either the Northeast or the Midwest, which runs counter to the substantial excess mortality among southern-born blacks reported in previous studies (Fang, Madhavan and Alderman 1996, 1997; Greenberg and Schneider 1992, 1995; Mancuso and Redmond, 1975; Schneider, Greenberg and Lu 1997a, 1997b). Blacks born in the West have 32.8 percent lower mortality and blacks born outside of the U.S. have 48 percent lower mortality than southern-born blacks, but these differentials attenuate slightly after adjusting for other factors.

The next pair of models estimate differences in mortality by region of residence. Mortality differentials by region of residence are similar to those by region of birth for whites but not for blacks. Whites residing in the Midwest and West experience mortality 5.1 percent and 8.8 percent lower, respectively, than whites living in the South, but the mortality difference between white residents of the Northeast and the South is small and insignificant (Table 1.2). However, controlling for differences in sociodemographic factors reveals a mortality advantage of 3.9 percent for residents of the Northeast. For blacks, the only significant regional difference in mortality is for the Midwest, which has 9.3 percent higher mortality than the South, but the gap narrows and becomes insignificant after controlling for

other factors (Table 1.3).

A number of previous studies suggest that place of birth is a stronger predictor of mortality than place of residence, a hypothesis tested in the last two models which estimate region-mortality associations for birthplace and residence simultaneously (Tables 1.2 and 1.3). The results show that the region-mortality associations for birthplace are hardly affected by the inclusion of region of residence in the models, supporting the notion of stronger origin effects/early life conditions among migrants. For whites, region of birth significantly predicts mortality in the joint models with only minor changes in the estimated hazard ratios, while mortality differences by region of residence become small and insignificant. Regional mortality differentials found in the separate birthplace and residence models for blacks are upheld in the joint models: western-born and foreign-born blacks have lower mortality than southern-born blacks, and blacks residing in the Midwest have higher mortality than blacks residing in the South. As in the earlier models, adjusting for sociodemographic factors eliminates the western-born advantage and the disadvantage among residents of the Midwest, but the foreign-born advantage remains large and highly significant. Overall, these results suggest that region of birth, which proxies macro-level conditions in early life, is a stronger predictor of mortality than region of residence in adulthood.

Hazard ratios for marital status, educational attainment, and metropolitan/urban residence from the adjusted models are not reported in Tables 1.2 and 1.3 because the primary interest of this study is how these controls affect associations between region and mortality rather than associations between mortality and the controls. Consistent with

expectations, estimates for the control variables indicate that married persons have significantly lower mortality than unmarried persons; there is an inverse, graded association between education and mortality; and there is a monotonic decline in mortality as areas become less urbanized.

Social Selectivity/Advantage

Table 1.4 presents differences in sociodemographic characteristics between migrants and non-migrants in the South and North, separately by race. Migrants are considered to be positively selected/advantaged if they are more likely to be married, have more years of schooling, and are less likely to live in central cities than stayers or natives. While the overall pattern in the table suggests that whites have more favorable sociodemographic characteristics than African Americans, the primary interest of this study is within-race comparisons between migrants and non-migrants. With few exceptions, differences between migrants and non-migrants are highly statistically significant because of large sample sizes within each region-migration category (especially for whites), yet some of these statistically significant differences are qualitatively unimportant.

Southern-born migrants exhibit a mixed pattern of social selectivity, with migrants being negatively selected for marriage and central city residence but positively selected for education relative to stayers regardless of race. For marriage, negative selectivity among southern-born migrants is greater for blacks than for whites, with the absolute difference in percent married between migrants and stayers being -2.3 percent among blacks and -0.4 percent among whites. Educational selectivity among southern-born migrants is greater for

whites than for blacks. White migrants have on average 0.6 more years of schooling than stayers, whereas black migrants have an additional 0.4 years of schooling. The most dramatic difference in selectivity between white and black migrants from the South is for central city residence. For blacks, 74.6 percent of southern-born migrants in the North live in central cities while only 46.4 percent of sedentary southerners live in these areas. Whites who migrated to the North are also more likely to live in central cities, but the overall levels and differences for migrants and non-migrants are much smaller.

For northern-born migrants who move to the South, social selectivity is more consistently positive than for those who migrated in the opposite direction. White migrants are positively selected for education and negatively selected for central city residence, but there is not a significant difference between migrants and stayers in terms of marriage. Mean years of schooling is 0.8 years higher for whites who migrated to the South than those who remained in the North. Less than one-quarter of northern-born whites live in central cities regardless of migration, though migrants to the South are somewhat more likely to live in these areas. In contrast to whites, blacks who migrated to the South exhibit positive selectivity for all characteristics shown. Fifty-six percent of migrants are married, compared with 45.3 percent of stayers. Black migrants to the South also have significantly more education and are much less likely to live in central cities than blacks who remain in the North.

The analysis of social selectivity generally accords with expectations. Since internal migration is largely driven by the pursuit of economic incentives and amenities at destination areas (Farley 1996), such pull factors suggest that migrants should be positively selected

from the origin population (Lee 1966). Although marriage and non-central city residence are less common among southern-born migrants than stayers, migrants tend to have higher levels of educational attainment, which is a key determinant of income, occupation, and health (Hummer, Rogers, and Eberstein 1998). Northern-born migrants, on the other hand, are positively selected on the basis of all three sociodemographic characteristics. Given the more consistent positive selectivity of northern-born migrants, mortality differences between migrants and stayers should be larger for the northern-born.

For characteristics of migrants to be intermediate between those of the origin and destination populations, as Lee (1966) hypothesizes, the patterns of social selectivity in Table 1.4 suggest that southern-born migrants should have less educational attainment but a greater likelihood of marriage and non-central city residence than northern natives, whereas northern-born migrants should be disadvantaged on all characteristics relative to southern natives. Whites and blacks who were born in the South and migrated to the North are, on average, had better educated than southern stayers but less educated than northern natives, which is consistent with expectations and previous research (Farley and Allen 1987; Tolnay 1998). The disadvantage in educational attainment is 0.4 years for whites and 1.8 years for blacks. For other characteristics, southern-born whites and blacks are more likely to be married (advantage) and are more heavily concentrated in central cities (disadvantage) than northern natives. In contrast, migrants to the South are better educated than southern natives, with the advantage in mean years of schooling being 1.8 years for whites and 3.0 years for blacks. Those who migrated to the South are less likely to be married than southern natives if they are white, but more likely to be married if they are black. Similar to migrants to the

North, migrants to the South are more likely to live in central cities than southern natives.

Although social selectivity among foreign-born migrants can not be assessed with these data, social (dis)advantage can be evaluated by comparing them to U.S.-born natives in their region of residence. The prevalence of marriage is lower for foreign-born whites than native whites in both regions, though the difference is not significant in the South. In contrast, foreign-born blacks are much more likely to be married than natives, especially in the North. Mean levels of educational attainment are higher for foreign-born migrants residing in the South than those living in the North, which translates into an educational advantage in the South but an educational disadvantage in the North. Also, the foreign-born tend to be more heavily concentrated in central cities than natives in each race-region category.

Comparisons between natives of the North and South show how characteristics would differ between these two regions with migrants excluded. Among whites, northern natives have higher educational attainment, are less likely to be married, and are more likely to live in central cities than southern natives. When the northern region is considered as a whole, thereby averaging the characteristics of white natives and migrants, southern-born and foreign-born migrants residing in the North tend to depress the mean level of education and the percentage married, but they increase the percentage living in central cities. For whites in the South, northern-born and foreign-born migrants raise the average level of education higher and the percentage living in central cities, but they lower the percentage married.

Blacks who are native to the North have, on average, 1.2 more years of educational attainment than blacks who are native to the South, yet northern blacks are much less likely

to be married and are much more likely to live in central cities. Southern-born and foreign-born blacks residing in the North depress the average level of education, but they increase the percentage married and percentage living in central cities. Average educational levels among blacks in the South benefit from the influx of northern and foreign migrants, and migrants are also more likely to be married and to live in central cities.

Mortality by Migration Status

The analysis of differences in mortality between migrants and stayers/natives employs the same region-migration classification used to assess social selectivity/advantage in Table 1.4. The direction of change for each region-migration hazard ratio after adjustment for sociodemographic factors indicates how mortality differences between migrants and non-migrants are mediated by social selectivity/advantage. For example, if positive social selectivity translates into lower mortality for migrants relative to stayers, then relative mortality between migrants and stayers should attenuate after controlling for educational attainment, marital status, and metropolitan/urban residence. In other words, the mortality advantage of migrants should be smaller after adjusting for their more favorable characteristics.[9] On the other hand, the mortality differential between natives and migrants should decrease after adjusting for the less favorable traits of negatively selected migrants. The same logic also applies to comparisons of migrants and natives in the area of destination: mortality relative to natives should increase for socially advantaged migrants but decrease

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9 If migrants have higher mortality than stayers in the unadjusted model (presumably due to unobserved factors), then the mortality differential should increase after adjusting for the more favorable sociodemographic characteristics of migrants.

for socially disadvantaged migrants after adjustment for sociodemographic factors. Mortality differences between migrants and non-migrants which remain after adjustment will reflect unmeasured individual-level or macro-level factors.

Models which estimate the hazard of death by region and migration status are presented in Table 1.5 for whites and in Table 1.6 for blacks. The first two models in each table estimate mortality relative to southern stayers/natives and the last two models compare each region-migration group to northern stayers/natives. As Table 1.5 shows, whites who migrated to the South have significantly lower mortality than whites native to that region, with the migrant mortality advantage being 8.2 percent for the northern-born and 17.2 percent for the foreign-born. Whites who migrated out of the South have mortality comparable to those who remained sedentary. The reduction or elimination of the mortality differential between migrants and natives in the South in the adjusted model suggests that the higher educational attainment of these migrant groups contributes to lower mortality even though they are more likely to be unmarried and to live in central cities (see Table 1.4). On the other hand, the higher educational attainment of whites who migrated out of the South does not result in lower mortality relative to southern stayers. Northern stayers/natives have significantly lower mortality than sedentary southerners in both the unadjusted and adjusted models, which suggests that there are protective effects associated with northern birth or residence for whites which are not captured by controls for educational attainment, marital status, and metropolitan/urban residence.

Interestingly, relative to blacks who have lived in the South their entire lives, only foreign-born migrants living in the North have significantly lower mortality (Table 1.6).

Northern-born and foreign-born blacks who migrated to the South and southern-born blacks who migrated to the North have significantly higher levels of education than native southerners (see Table 1.4), but such educational selectivity/advantage does not translate into significantly lower mortality for these migrant groups.[10] Relative to northern stayers/natives, foreign-born migrants living in either region have significantly lower mortality in the unadjusted model, but only the mortality advantage of foreign-born migrants in the North remains significant after adjusting for sociodemographic factors. Although the positive selectivity of northern-born blacks who moved to the South to is expected to translate into lower mortality relative to northern stayers–the hazard ratios are below 1.0 in both the unadjusted and adjusted models–the relatively small size of this migrant group may prevent the coefficients from attaining statistical significance.

CONCLUSION

The primary aim of this study is to examine whether early life conditions directly influence adult mortality or operate primarily through intervening current status variables. Since detailed survey data about the childhood social and environmental circumstances of adults is exceptionally rare, region of birth is used as a proxy for these circumstances. The results provide novel evidence concerning mortality differentials by birthplace and the link between social and health selectivity of migrants. Some of the results will be briefly reviewed and placed within the context of previous research, and followed by a discussion

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10 It should be noted that northern-born migrants to the South and foreign-born migrants are relatively small groups with few deaths (see Table 1.4), making it difficult to draw firm conclusions from the multivariate results. On the other hand, southern stayers, northern stayers, and southern-born migrants are sufficiently large groups that significant associations with mortality should be detected if in fact they do exist.

of strengths and weaknesses of this study.

The evidence presented here does not corroborate the substantial excess mortality of southern-born blacks over midwestern-born and northeastern-born blacks reported in previous studies. Although blacks born in the West and outside the U.S. have significantly lower mortality than blacks born in the South, these birthplace groups represent only 1.8 percent and 2.8 percent, respectively, of the total African American population. Thus, for the overwhelming majority of blacks region of birth is not a key determinant of mortality. On the other hand, whites born in the Midwest, the West, or in another country have significantly lower mortality than whites born in the South. Furthermore, as the joint birthplace-residence models in Table 1.2 show, place of birth is a more robust predictor of mortality than place of residence among whites. That the mortality advantage of the western-born and foreign-born is similar across blacks and whites suggests that protective factors associated with being born in the West or in another country do not depend on race. Migrants from abroad are often positively selected for health from their origin populations which may translate into markedly lower mortality than native-born residents of the U.S. (Hull 1979; Hummer et al. 1999). Given the diversity of economic, social, and environmental conditions in the West, it is difficult to speculate about regional factors that are protective against mortality throughout life. On the basis of previous research (Anderson et al. 1996; Haan, Kaplan, and Camacho 1987; Geronimus et al. 1996, 1999; Harburg et al. 1973; McCord and Freeman 1990; LeClere, Rogers, and Peters 1997; Robert 1998), the immediate surrounding community would seem to be the most salient macro-level in determining health risks rather than a large, heterogeneous region.

Since migrants differ from non-migrants in nonrandom ways (Lee 1966), this study investigated whether mortality differences between migrants and non-migrants are largely determined by differences in sociodemographic characteristics or by unmeasured factors associated with region of origin. After reviewing previous research on social and health selectivity among migrants, a typology of hypothesized relations between migrant selectivity/advantage and mortality differentials between migrants and stayers/natives was developed (Table 1.1). Social selectivity/advantage was assessed for educational attainment, marital status, and metropolitan/urban residence. Southern-born migrants are positively selected for education but negatively selected for marriage and central city residence relative to stayers, whereas northern-born migrants are positively selected for all characteristics relative to stayers. Southern-born migrants had less education than northern natives, but northern-born migrants had more education than southern natives. The prevalence of marriage varied between migrants and natives, but migrants were more heavily concentrated in central cities than natives. When social selectivity/advantage was considered in relation to mortality, educational attainment appeared to be the most important sociodemographic factor affecting mortality differentials between migrants and non-migrants. As expected, migrants with higher levels of educational attainment relative to stayers/natives usually had lower mortality as well. Foreign-born migrants residing in the North maintained a substantial mortality advantage over natives despite having less education. Marital status and central city residence appeared to play more secondary roles to education as determinants of migrant mortality differentials. Although the number of characteristics used to distinguish between migrants and non-migrants was limited, the results show that mortality differentials between

these two groups are associated with a combination of individual-level and macro-level factors.

There are two important limitations of this study. First, the ability to detect statistically significant associations with mortality among African Americans may be limited by relatively small sample sizes in some region-migrant groups. As Table 1.4 shows, few African Americans in the sample are foreign-born or are northern-born migrants residing in the South. However, although there were only 29 deaths among foreign-born blacks living in the North, this group was found to have significantly lower mortality than southern and northern natives before and after adjusting for sociodemographic factors. A second important limitation is the lack of information in the NLMS on age at migration. Since the effects of macro-level conditions on mortality certainly depend on the duration of exposure to such conditions, the ability to control for how long migrants lived in their region of origin would provide more precise results. Despite these limitation, the NLMS is the best data source currently available to investigate mortality differentials by region of birth and migration status.

This study has several strengths which distinguish it from previous research. First, it examined regional and migration differentials in mortality for African Americans and whites, whereas a number of previous studies have focused only on blacks. Second, because the analysis uses data from an individual-level, prospective mortality study, the results are not susceptible to biases which can plague mortality studies based on aggregate data. Inconsistencies in how place of birth is reported in vital statistics and census data can seriously distort mortality differentials between migrants and non-migrants. Information on

place of birth in the NLMS come from a single source–the baseline CPS–which avoids such distortions. Nonetheless, the NLMS is subject to approximately 5 percent ascertainment loss due to problems matching records to the NDI (Rogot, Sorlie, Johnson, and Schmitt 1992), which could introduce bias into the results if migrants were less likely than non-migrants to be successfully matched. Such bias was minimized by controlling for presence of a social security number on the CPS record, which greatly improves the probability of a successful match.

TABLE 1.1 Hypothesized Relations between Migrant Selectivity/Advantage and Mortality by Region of Birth and Region of Residence

Region of Birth	Region of Residence	
	North	South
North	Northern stayers/natives - Low mortality relative to southern stayers/natives.	Northern-born migrants to South - Low (high) mortality relative to northern stayers if migrant selectivity is positive (negative). - Low (high) mortality relative to southern natives if migrants are advantaged (disadvantaged).
South	Southern-born migrants to North - Low (high) mortality relatives to southern stayers if migrant selectivity is positive (negative). - Low (high) mortality relative to northern natives if migrants are advantaged (disadvantaged).	Southern stayers/natives - High mortality relative to northern stayers/natives
Foreign-born	Foreign-born migrants to North - Low mortality relative to northern natives.	Foreign-born migrants to South - Low mortality relative to southern natives.

TABLE 1.2 Hazard Ratios of Death by Region of Birth and Region of Residence, Whites, 1980-1989

	Birthplace Model		Residence Model		Birthplace-Residence Model	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Region of Birth						
South	1.000	1.000			1.000	1.000
Northeast	0.984	0.985			0.967	0.998
	(0.95,1.02)	(0.95,1.02)			(0.92,1.01)	(0.95,1.05)
Midwest	0.924**	0.936**			0.919**	0.954*
	(0.90,0.95)	(0.91,0.96)			(0.88,0.96)	(0.92,0.99)
West	0.848**	0.880**			0.856**	0.893**
	(0.81,0.89)	(0.84,0.92)			(0.81,0.91)	(0.85,0.94)
Foreign-born	0.838**	0.810**			0.829**	0.821**
	(0.80,0.88)	(0.77,0.85)			(0.79,0.87)	(0.78,0.87)
Region of Residence						
South			1.000	1.000	1.000	1.000
Northeast			0.985	0.961*	1.024	0.981
			(0.95,1.02)	(0.93,0.99)	(0.98,1.07)	(0.94,1.02)
Midwest			0.949**	0.937**	1.011	0.973
			(0.92,0.98)	(0.91,0.97)	(0.97,1.05)	(0.93,1.01)
West			0.912**	0.925**	0.989	0.981
			(0.88,0.94)	(0.90,0.96)	(0.95,1.03)	(0.94,1.03)
-2 Log L	626,387	625,516	626,446	625,594	626,375	625,514
LR χ^2 (df)	54,536 (8)	55,407 (21)	54,476 (7)	55,328 (19)	54,547 (12)	55,409 (24)

NOTE: +p<.10, *p<0.05, **p<0.01; 1.000 - reference category; 95 percent confidence limits for hazard ratios in parentheses. Data are from the National Longitudinal Mortality Study. For all models there are a total of 262,557 observations and 31,175 deaths. All models control for age, sex, and presence of Social Security number on the death certificate. Adjusted models also include controls for marital status, education, and metropolitan/urban residence. Categories for missing region of birth/residence not shown.

TABLE 1.3 Hazard Ratios of Death by Region of Birth and Region of Residence, Blacks, 1980-1989

	Birthplace Model		Residence Model		Birthplace-Residence Model	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Region of Birth						
South	1.000	1.000			1.000	1.000
Northeast	1.081 (0.92,1.27)	1.122 (0.96,1.32)			1.056 (0.89,1.26)	1.140 (0.96,1.36)
Midwest	0.974 (0.85,1.11)	1.014 (0.89,1.16)			0.917 (0.80,1.06)	0.979 (0.85,1.13)
West	0.672+ (0.45,1.01)	0.696+ (0.46,1.05)			0.691+ (0.46,1.05)	0.719 (0.48,1.09)
Foreign-born	0.520** (0.39,0.70)	0.537** (0.40,0.73)			0.513** (0.37,0.70)	0.546** (0.40,0.74)
Region of Residence						
South			1.000	1.000	1.000	1.000
Northeast			1.014 (0.92,1.12)	0.963 (0.87,1.07)	1.057 (0.95,1.18)	0.980 (0.87,1.10)
Midwest			1.093* (1.01,1.19)	1.049 (0.96,1.15)	1.117* (1.02,1.22)	1.054 (0.96,1.16)
West			0.905 (0.79,1.04)	0.899 (0.78,1.03)	0.930 (0.81,1.07)	0.916 (0.80,1.05)
-2 Log L	65,735	65,562	65,749	65,584	65,719	65,558
LR χ^2 (df)	4,663 (8)	4,836 (21)	4,649 (7)	4,812 (19)	4,679 (12)	4,840 (24)

NOTE: +p<.10, *p<0.05, **p<0.01; 1.000 - reference category; 95 percent confidence limits for hazard ratios in parentheses. Data are from the National Longitudinal Mortality Study. For all models there are a total of 27,664 observations and 3,583 deaths. All models control for age, sex, and presence of Social Security number on the death certificate. Adjusted models also include controls for marital status, education, and metropolitan/urban residence. Categories for missing region of birth/residence not shown.

TABLE 1.4 Differences in Characteristics by Region of Residence and Migration Status, Whites and Blacks, 1980-1989

Race/Variable	South			North		
	Stayer/ Native	U.S.-born Migrant	Foreign-born	Stayer/ Native	U.S.-born Migrant	Foreign-born
Whites						
Mean years of schooling	11.4	13.2 a,b	12.4 c	12.4 d	12.0 a,b	10.9 c
Percent married	76.0	74.7 b	71.8	74.0 d	75.6 a,b	69.2 c
Percent central city/urban	18.6	23.4 a,b	32.1 c	21.5 d	22.6 a,b	37.5 c
Observations	51,680	14,147	1,733	159,140	13,255	11,075
Deaths	6,391	1,694	268	17,953	1,592	2,043
Blacks						
Mean years of schooling	9.9	12.9 a,b	12.4 c	12.1 d	10.3 a,b	11.3 c
Percent married	53.0	55.9 a	59.8 c	45.3 d	50.7 a,b	61.6 c
Percent central city/urban	46.4	58.0 a,b	53.1 c	71.3 d	74.6 a,b	77.2 c
Observations	13,636	526	256	4,477	6,709	513
Deaths	1,929	47	14	381	1,040	29

NOTE: a $p<.01$ difference, U.S.-born migrants versus stayers in their region of birth (selectivity).
b $p<.01$ difference, U.S.-born migrants versus natives in their region of residence (advantage).
c $p<.01$ difference, foreign-born migrants versus natives in their region of residence (advantage).
d $p<.01$ difference, southern stayers/natives versus northern stayers/natives (region).
Data are from the National Longitudinal Mortality Study. Characteristics not shown for 11,527 whites and 1,547 blacks for whom either place of birth or place of residence is missing.

TABLE 1.5 Hazard Ratios of Death by Region of Residence and Migration Status, Whites, 1980-1989

	Comparisons with Southern Stayers/Natives		Comparisons with Northern Stayers/Natives	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Region of Residence-Migration status				
South - Stayer/Native	1.000	1.000	1.070** (1.040,1.101)	1.062** (1.032,1.093)
South - U.S.-born Migrant from North	0.918** (0.870,0.969)	0.968 (0.917,1.022)	0.982 (0.935,1.033)	1.028 (0.978,1.081)
South - Foreign-born Migrant	0.828** (0.732,0.935)	0.841** (0.744,0.951)	0.885* (0.785,0.999)	0.893+ (0.792,1.008)
North - Stayer/Native	0.935** (0.908,0.962)	0.942** (0.915,0.969)	1.000	1.000
North - U.S.-born Migrant from South	1.001 (0.948,1.058)	0.997 (0.944,1.054)	1.071** (1.018,1.128)	1.059* (1.006,1.115)
North - Foreign-born Migrant	0.838** (0.797,0.881)	0.802** (0.762,0.844)	0.896** (0.856,0.939)	0.852** (0.813,0.893)
-2 Log L	626,427	625,539	626,428	625,539
LR χ^2 (df)	54,496 (9)	55,384 (22)	54,494 (8)	55,383 (21)

NOTE: +p<.10, *p<0.05, **p<0.01; 1.000 - reference category; 95 percent confidence limits for hazard ratios in parentheses. Data are from the National Longitudinal Mortality Study. For all models there are a total of 262,557 observations and 31,175 deaths. All models control for age, sex, and presence of Social Security number on the death certificate. Adjusted models also include controls for marital status, education, and metropolitan/urban residence. Category for missing region of birth/residence not shown.

TABLE 1.6 Hazard Ratios of Death by Region of Residence and Migration Status, Blacks, 1980-89

	Comparisons with Southern Stayers/Natives		Comparisons with Northern Stayers/Natives	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Region of residence-Migration status				
South - Stayer/Native	1.000	1.000	0.972 (0.870,1.086)	0.969 (0.862,1.089)
South - U.S.-born Migrant from North	0.913 (0.683,1.219)	1.018 (0.760,1.363)	0.887 (0.655,1.201)	0.986 (0.727,1.336)
South - Foreign Migrant	0.654 (0.387,1.107)	0.686 (0.405,1.161)	0.636+ (0.373,1.084)	0.664 (0.389,1.133)
North - Stayer/Native	1.029 (0.921,1.150)	1.032 (0.919,1.160)	1.000	1.000
North - U.S. Migrant from South	1.060 (0.983,1.144)	1.007 (0.927,1.093)	1.030 (0.915,1.160)	0.975 (0.865,1.099)
North - Foreign Migrant	0.494** (0.342,0.712)	0.491** (0.339,0.710)	0.480** (0.329,0.700)	0.476** (0.326,0.694)
-2 Log L	65,735	65,566	65,739	65,570
LR χ^2 (df)	4,663 (9)	4,831 (22)	4,658 (8)	4,827 (21)

NOTE: +p<.10, *p<0.05, **p<0.01; 1.000 - reference category; 95 percent confidence limits for hazard ratios in parentheses. Data are from the National Longitudinal Mortality Study. For all models there are a total of 27,664 observations and 3,583 deaths. All models control for age, sex, and presence of Social Security number on the death certificate. Adjusted models also include controls for marital status, education, and metropolitan/urban residence. Category for missing region of birth/residence not shown.

CHAPTER 2

The Impact of Medicare on Old-Age Mortality, 1966-1995

Between 1994 and 1998 the number of Americans lacking health insurance increased by roughly one million each year–from 39.7 to 44.3 million–leaving one out of every six Americans without coverage from either a private or government plan (U.S. Bureau of the Census 1995, 1996, 1997a, 1998, 1999). When compared to those with health insurance, the uninsured experience lower rates of health service utilization, obtain less adequate health care, are in poorer health, and are at greater risk of mortality (Franks, Clancy, and Gold 1993; Hadley, Steinberg, and Feder 1991; Sorlie, Johnson, Backlund, and Bradham 1994; U.S. Congress, Office of Technology Assessment 1992). Lack of health insurance is most prevalent among children and young adults, racial and ethnic minorities, the poorly educated, the unemployed, and the foreign-born, while one demographic group–older adults–has had nearly universal health coverage since the mid-1960s (Gornick et al. 1996).

Many analysts assert that Medicare helps older Americans live longer, healthier, and more independent lives by making widely available numerous medical procedures that lower risks of mortality and disability (Aiken and Bays 1984; Cassel, Besdine, and Siegel 1999; Fuchs 1999; Goldman and Cook 1984; Gornick et al. 1996; Manton, Stallard, and Corder 1995; McClellan and Noguchi 1998; Vladeck and King 1995). Access to health care services among persons aged 65 and older greatly increased under Medicare, and disparities in access by income and race have been largely eliminated (Long and Settle 1984; Gornick et al.

1996). More than 90 percent of older Medicare beneficiaries report having a regular source of care, while two-thirds of those without a regular source of care report themselves as seldom or never sick (Adler 1995). By reducing the financial burden of medical expenses, Medicare has also helped lower poverty rates among the elderly (Moon 1993; Vladeck 1999).

Following a long period of stagnation in U.S. mortality decline during the 1950s and 1960s, large improvements in life expectancy at older ages occurred soon after Medicare was established, providing support for claims that Medicare has contributed to better health and lower mortality (Aiken and Bays 1984; Cassel, Besdine, and Siegel 1999; Drake 1978; Fuchs 1999; Preston 1984; Gornick et al. 1996; Vladeck and King 1995). Of the 5.8-year increase in life expectancy at age 65 between 1900 and 1997, a gain of 3.1 years (53.4 percent) occurred during the three decades when Medicare was operating (National Center for Health Statistics [NCHS] 1968, 1999a). Even after controlling for sociodemographic and ecological characteristics, increases in Medicare spending per beneficiary are associated with significantly lower mortality rates at older ages across geographic areas (Hadley 1988). Though the elderly are often excluded from studies of the association between health insurance and mortality because of nearly universal coverage through Medicare, studies show that the uninsured are at a greater risk of dying than those with health insurance after controlling for sociodemographic factors, prior health status, and various risk factors (Franks, Clancy, and Gold 1993; Hadley, Steinberg, and Feder 1991; Sorlie, Johnson, Backlund, and Bradham 1994).

Several empirical studies support the hypothesis that increased access to medical care through Medicare has contributed to lower mortality at older ages. A cohort analysis of U.S.

death rates for the period 1934-69 which compared changes in death rates after 1966 for younger (<65) and older (65+) age groups found a significant improvement in mortality for older white males associated with Medicare (Friedman 1976). When compared to model life tables, the largest improvements in mortality in the U.S. between 1968 and 1980 were at older ages, with a notable discontinuity suggested at age 65 for females–the minimum age for receiving Medicare benefits (Preston 1984). Although U.S. mortality is relatively high at ages below 65 compared with mortality in Sweden, France, England, and Japan, until very recently life expectancy at age 80 was higher in the U.S. than in these other countries. Lower mortality at older ages in the U.S. has been attributed to fewer disparities in economic status and health insurance coverage through Social Security, Medicare, and Medicaid benefits, as well as more effective medical care at older ages in the U.S. than in other countries (Manton and Vaupel 1995). Although these other countries have universal health insurance coverage, health care at older ages may be rationed less in the U.S. than elsewhere.

This study investigates Medicare's influence on U.S. mortality at older ages between 1966 and 1995. Because Medicare enrollment is nearly universal among older adults, observed death rates at ages 65 and older during this period correspond to the mortality experience of the Medicare beneficiary population. The analysis begins by estimating a baseline model for U.S. death rates at ages 45-99 from 1960 to 1995. The baseline model is then modified to account for Medicare and used to generate death rates for ages 65-99 that simulate conditions might have prevailed if Medicare had not been implemented. Observed and simulated mortality conditions are used to calculate trends in life expectancy at age 65 to assess the proportion of increases in longevity attributable to Medicare. Finally, observed

and predicted death rates are used to project the population aged 65 and older from 1966 to 1996 to estimate growth of the elderly population associated with Medicare.

OVERVIEW OF MEDICARE

Before the introduction of Medicare, health insurance for the elderly was provided only through employers, the Veteran's Administration, and private and community-based (i.e., Blue Cross) plans. National survey data for 1962 and 1963 show that only about 52 percent of the elderly population had hospital insurance, and only about 44 percent had surgical insurance prior to Medicare (Reed 1965).[1] Health insurance coverage among the elderly declined as age increased, was lower for nonwhites than for whites, and was lower among persons living in rural areas compared with urban dwellers (Hoffmann 1964). Among persons who reported their health status as "good," 58 percent of men and 62 percent of women 65 years of age and older had some form of health insurance, but only 37 percent of older men and women who reported their health status as "poor" were covered by health insurance (Rice 1964). These disparities in health insurance coverage were greatly reduced after the introduction of Medicare, which extended health insurance to those in greatest need of medical care–the oldest old, the poor, and those with prior health conditions.

In 1965 Congress passed an amendment to the Social Security Act establishing two health care programs for vulnerable segments of the population: Medicare for the elderly and Medicaid for the poor. Medicare was created to "increase access to health care services and

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1 The Public Health Service conducted a national survey for the period July 1962-June 1963, which showed that only 54 percent of the noninstitutionalized elderly population had hospital insurance. The Social Security Administration conducted a national survey in December of 1962, and found that only 51 percent of the elderly population had hospital insurance and 43 percent had surgical insurance.

to reduce the financial burden of the high costs of medical care" for Americans aged 65 and older (Gornick, Greenberg, Eggers, and Dobson 1985) and tremendous progress has been made toward realizing these goals (Davis and Reynolds 1976; Long and Settle 1984; Moon 1993; Vladeck and King 1995). When Medicare began operation on July 1, 1966, all but about 150,000 Americans over age 65 were covered by Medicare (Gornick, Greenberg, Eggers, and Dobson 1985). Beginning in 1975, adults reaching age 65 were required to have the necessary number of quarters of employment for retired-worker benefits to be eligible for enrollment in Medicare (women who did not have a work history, most of whom were married, could enroll as dependents). This change in enrollment criteria excluded about one million persons 65 years of age or older from the program, about 250,000 of whom were Federal civil service annuitants (Gornick 1976), a group which obtained Medicare coverage beginning in 1982 (Gornick, Greenberg, Eggers, and Dobson 1985). The elimination of special enrollment provisions in Medicare's early years resulted in Medicare enrollment among the elderly declining from about 99 percent during its first year to about 96 percent nearly a decade later, with enrollment remaining around 96 or 97 percent ever since (Gornick et al. 1996; NCHS 1999a).

Medicare is the largest publicly-funded healthcare program in the United States. Between 1967 and 1997, the number Medicare enrollees aged 65 and above increased from 19 to 34 million persons, while expenditures increased from $4.6 billion to $214.6 billion (Gornick, Greenberg, Eggers, and Dobson 1985; Iglehart 1999). Medicare expenditures made up less than 2 percent of total federal outlays and about 5 percent of social welfare expenditures during its first full year of operation (fiscal year [FY] 1967), but by 1997 the

program consumed more than 12 percent of the federal budget (U.S. Bureau of the Census 1997b). Medicare expenditures increased at an average of 13.6 percent per year between 1970 and 1995, owing largely to the growth of the elderly population and advancements in medical technology (Cassel, Besdine, and Siegel 1999; Fuchs 1999; Gornick et al. 1996; McClellan and Noguchi 1998). The aging of the baby-boom cohort and continued declines in mortality at older ages will increase the proportion of the population covered by Medicare and their expected duration of coverage.

Medicare consists of two separate but complementary health care programs: a hospital insurance plan, also called Part A, and a supplementary medical insurance plan, or Part B. Part A covers inpatient diagnostic services, hospital care, and post-hospital care, and is available to all persons aged 65 years or older who are eligible for social security retirement benefits. Part B is a voluntary plan that covers physicians' and surgeons' services, home health services, and various other medical expenses not covered under Part A. Reimbursement for prescription drugs is not included under either plan. Enrollees in Part B are required to pay monthly premiums, and the plan is available to anyone covered by Part A. Among those enrolled in Medicare's hospital insurance program (Part A), 96 percent are also enrolled in the voluntary supplemental medical insurance program (Part B). Furthermore, about 10-12 percent of elderly Medicare enrollees are also eligible for Medicaid (Gornick et al. 1996), which acts as a supplementary insurance program for low-income elders by paying Medicare premiums and cost-sharing expenses and covering additional services, such as prescription drugs (Iglehart 1999). Eighty-one percent of Medicare beneficiaries aged 65 and above have private supplemental health insurance in addition to

Medicare coverage, while only 8 percent of beneficiaries are covered by Medicare alone (Adler 1995). Of the roughly 4 percent of older adults not covered by Medicare, 3 percent are enrolled in private plan while less than 1 percent have no coverage at all (NCHS 1999a).

Following the introduction of Medicare and Medicaid, the share of health expenses for the elderly paid for by public funds nearly doubled within one year. In FY1966–the year before Medicare was introduced–only 31 percent of health expenditures among persons 65 years of age and older were paid by public funds. During FY1967–Medicare's first year of operation–public outlays increased to 59 percent of the health expenditures among the elderly, with Medicare covering 35 percent and other public funds covering 24 percent of total expenditures (Rice, Anderson, and Cooper 1968). Data from the 1992 Medicare Current Beneficiary Survey show that Medicare covers about 55 percent of personal health care expenditures among aged beneficiaries, with the remaining share distributed among Medicaid (12 percent), private supplemental insurance (10 percent), out-of-pocket payments (21 percent), and other sources (2 percent; Gornick et al. 1996).

DATA AND METHODS

Mortality

Mortality data used in this study were abstracted from the Berkeley Mortality Database (see Wilmoth 2000 for information on original data sources). U.S. death rates and life tables for the total population by single years of age and sex were obtained for each year from 1960 to 1995. The life tables use 110+ as the open-ended age category. This study uses age 100 as the minimum age for the open-ended category, which is obtained by dividing

life table deaths for ages 100+ by person-years of exposure at these ages.

The Medicare Population

The Medicare population is defined as all persons in the U.S. aged 65 and older during the period from mid-year 1966 through the end of 1995 for the following reasons: 1) Medicare was introduced abruptly on July 1, 1966; 2) enrollees are required to be at least 65 years of age; and 3) enrollment has been nearly universal and continuous among adults aged 65 and older since the program began (Gornick, Greenberg, Eggers, and Dobson 1985). Given the age criterion for eligibility and continuous health coverage over time, the Medicare population could be most simply represented by a dummy variable equal to 1 for ages 65 and older from 1966 to 1995, and 0 otherwise. However, such a variable would treat all Medicare participants the same regardless of duration of enrollment in the program, as well as require the assumption that Medicare began on January 1, 1966. Instead, a series of dummy variables represents the Medicare population by duration of enrollment, allotting only a half-year of coverage for 1966. The following duration intervals are employed: <5 years, 5-10 years, 10-15 years, 15-20 years, 20-25 years, and 25-30 years.[2] Figure A2.1 in the Appendix shows a lexis diagram representing the duration of enrollment in Medicare by age and time. Persons enrolled in the Medicare program for less than five years includes ages 65-99 from 1966 to 1970 and ages 65-69 from 1971 to 1995, persons enrolled for 5-10 years includes ages 70-99 from 1971 to 1975 and ages 70-74 from 1976 to 1995, and so on.

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2 A linear representation of average duration of enrollment in Medicare yielded similar results, but the specification obscured the non-linear relationship between duration of enrollment and mortality.

This specification assumes that the relationship between duration of enrollment and mortality does not depend on age. Furthermore, age and cohort are confounded because, for instance, only persons aged 85+ fall into the 15-20 year enrollment category and only persons aged 90+ fall into the 25-30 year enrollment category.

Statistical Model

The central aim of this study is to simulate mortality conditions that might have prevailed among older Americans if Medicare had not been introduced. Simulating such conditions by extrapolating pre-Medicare mortality trends into the future would require assumptions about mortality change for adults aged 65 and older over nearly three decades. Because enrollment is nearly universal, observed U.S. death rates for ages 65+ from 1966 to 1995 represent, to a close degree, actual mortality conditions for the Medicare population: Medicare's influence on mortality in the older population is reflected in these rates. Observed rates also reflect influences on mortality other than access to medical care, such as changes in the distribution of education, income, and biomedical risk factors. By adjusting observed rates for the influence of Medicare rather than using extrapolation methods, changes in these other factors are also captured by the coefficients of the model.

To simulate mortality conditions in the absence of Medicare, a statistical model is fit to observed death rates over the period 1960-95 while controlling for duration of enrollment in the Medicare program. First, observed death rates are modeled using a relational model of mortality at older ages within low-mortality populations (Himes, Preston, and Condran 1994). Himes and colleagues developed a standard schedule of death rates for ages 45-99

derived from high-quality mortality data from 16 industrialized nations between 1950 and 1985. Death rates in a particular population can be efficiently modeled as a linear transformation of the standard mortality schedule using the following expression:

$$Y(x,t) = a(t) + b(t)Y^S(x) \qquad \textbf{(2.1)}$$

where $Y(x,t)$ is the logit of the death rate at age x in year t in the population of interest,[3] $Y^s(x)$ is the logit of the standard death rate at age x, $a(t)$ is the intercept parameter for year t, and $b(t)$ is the slope parameter for year t. The intercept parameter, $a(t)$, represents the level of mortality for year t in the observed population relative to the standard when the logit of the standard death rate equals 0 (or, equivalently, when $m^S(x)=0.5$): age 100 for females and age 98 for males. The slope parameter, $b(t)$, indicates the observed population's deviation in year t from the age pattern of mortality in the standard: when $b(t)$ is below 1.0 death rates in the population increase less rapidly with age than those in the standard, and when $b(t)$ is above 1.0 death rates in the population increase more rapidly with age than those in the standard (Himes 1994). As described by Himes and colleagues, a "change in [$a(t)$] shifts the logits of all age-specific death rates by an equal amount, while a change in [$b(t)$] shifts the logits of all death rates below age 100 for females and below age 98 for males in the same direction, but more at older than at younger ages" (1994:285).

Just as observed death rates for ages 65+ between 1966 and 1995 reflect Medicare's influence on mortality, the estimated level and slope parameters from the relational model

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3 The logit of the death rate at age x in year t is calculated using the following expression: $\ln[m(x,t)/(1-m(x,t))]$.

also reflect the effect of the program over time. If Medicare contributed to lower mortality, then the level and/or slope parameters should be lower during the period 1966-95 than they would have been if Medicare had not been introduced. Medicare is hypothesized to have affected mortality in the following two ways. First, it is hypothesized that Medicare reduced the overall level of mortality–death rates at all ages 65 and above declined by a proportionate amount. Second, it is hypothesized that Medicare lowered the slope of mortality–the rate of increase in death rates with age decreased at ages 65 and above. Adding the enrollment variables to the Himes model adjusts the level and slope parameters for enrollment in the Medicare program. The hypothesized effect of Medicare on mortality predicts that the coefficients for the enrollment variables will be negative, indicating an inverse relationship between exposure to Medicare and mortality. This modified relational model, referred to as the Medicare model, is specified as follows:

$$Y(x,t) = a'(t) + c(i)D(i) + b'(t)Y^S(x) + d(i)D(i)Y^S(x) \qquad (2.2)$$

where $D(i)$ represents a series of dummy variables for the i^{th} duration interval of enrollment in Medicare; $a'(t)$ and $b'(t)$ are the Medicare-adjusted level and slope parameters, respectively, for year t; and $c(i)$ and $d(i)$ are series of parameters to be estimated.

By modeling the duration of enrollment in Medicare, predicted death rates calculated from the Medicare model (equation 2.2) provide a closer approximation of observed mortality conditions than the basic Himes model (equation 2.1; results not shown). Removing the Medicare enrollment terms from the estimated equation and using only the

Medicare-adjusted level and slope parameters and the standard mortality schedule to calculate predicted death rates provides a series of mortality schedules that simulate mortality conditions that might have prevailed if Medicare had not been introduced. The following equation, referred to as the No Medicare model, is used to generate death rates that simulate the absence of Medicare:

$$Y'(x,t) = a'(t) + b'(t)Y^{S}(x) \qquad (2.3)$$

where $Y'(x,t)$ is the predicted logit of the death rate at age x in year t after being adjusted for the effect of Medicare in equation 2.2.[4]

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4 The models in equations 2.1 and 2.2 were estimated for ages 45-99 from 1960 to 1995 using PROC NLIN in SAS (Version 6.12), a regression procedure that uses iterative least-squares methods to estimate model parameters. The NLIN procedure contains five different iterative methods: gradient, Newton, modified Gauss-Newton, Marquardt, and multivariate secant (for more details, see pp. 1151-1155 in SAS Institute, Inc. 1989). Each method uses a different algorithm to iteratively converge upon estimates of the model parameters. The sensitivity of parameter estimates to choice of iterative method and parameter starting values was assessed using the following convergence criteria: $(SSE^{j-1} - SSE^{j})/(SSE^{j} + 10^{-6}) < 10^{-14}$, where SSE^{i} is the sum of squared errors for the j^{th} iteration.

The parameter estimates were not sensitive to the choice of iteration method or starting values. Using starting values $a(t)=0$ and $b(t)=0$ for the Himes model (equation 2.1), the Newton, Gauss-Newton, Marquardt, and secant methods yielded parameter estimates for $a(t)$ and $b(t)$ that were in agreement to at least eleven decimal places, whereas the gradient method yielded parameter estimates that were in agreement with estimates from the other methods to at least five decimal places. The Newton and Gauss-Newton methods converged on the exact same parameter values for $a(t)$ and $b(t)$. For the Medicare model (equation 2.2), using parameter starting values $a(t)=0$, $b(t)=0$, $c(i)=0$, and $d(i)=0$, yielded parameter estimates from the Newton, Gauss-Newton, Marquardt, and secant methods that were in agreement to ten or more decimal places, while the Newton and Gauss-Newton methods converged values for the parameter that agreed exactly. The Newton and Gauss-Newton method yielded the most consistent parameter estimates, but the Newton method was used to obtain the final estimates because its algorithm uses direct calculations of second derivatives of the parameters rather than approximations as in the Gauss-Newton method. Using the Newton method, varying the starting values for the parameters between -1 and 1 resulted in parameter estimates that were in agreement to at least thirteen decimal places for the Himes model and to at least fifteen decimal places for the Medicare model.

Life Tables and Projections

Death rates predicted from each of the models described above are used to calculate life tables by single years of age and sex from 1960 to 1995. Observed death rates are used at ages 0-65 and 100+. To estimate the share of growth in the elderly population attributable to Medicare, the U.S. population aged 65 and older is projected from 1960 to 1996 using survival ratios based on predicted death rates. The baseline population for the projections is the total U.S. population aged 30 and older in 1960 by sex (U.S. Bureau of the Census 1964). The cohort component projection method is employed following the procedures described in Preston, Heuveline, and Guillot (2000:Chapter 6). The population is assumed to be closed to migration; the only source of attrition from the population is death. Given death rates and population estimates by single years of age and time, the projection interval is one year. The difference between the sizes of the projected populations aged 65 and older in 1996 based on mortality conditions predicted by the Medicare and No Medicare models provides an estimate of the growth of the elderly population during the period 1966-95 attributable to Medicare.

RESULTS

Parameter Estimates

Parameter estimates and asymptotic standard errors for the models are presented in Tables 2.1-2.4. Table 2.1 presents results for the Himes model (equation 2.1) for males, and Table 2.2 presents similar results for females. Results for the Medicare model (equation 2.2) are presented for males in Table 2.3 and for females in Table 2.4. Trends in level parameters

are shown in Figure 2.1 and trends in slope parameters are shown in Figure 2.2.

As Figure 2.1 shows, level parameters, $a(t)$, from the Himes model for males and females were less than zero and declined over time throughout the period 1960-95. This general pattern indicates that U.S. mortality has been consistently lower than that of the standard and conditions have improved over time. These results are similar to those for U.S. whites reported by Himes (1994) and are consistent with observed mortality trends. Mortality declines in the U.S. have been more pronounced for women than for men at older ages since 1960 (NCHS 1999a). Level parameters from the Medicare model are also below zero throughout the period 1960-95 for males and females, but the parameters are closer to zero (i.e., mortality levels are estimated to be higher) between 1966 and 1995 than in the Himes model. Trends in level parameters are similar in both models for males, with the level of mortality being somewhat higher after adjusting for Medicare enrollment. Adjusting for Medicare among females results in level parameters that increase over time. In sum, patterns over time in level parameters for both males and females suggest that mortality is higher after controlling for the duration of enrollment in Medicare, as predicted by this study's first hypothesis. In other words, some of the improvements in U.S. mortality at older ages may be attributable to Medicare.

The age pattern of mortality relative to the standard is summarized by the slope parameters, $b(t)$. For both males and females, slope parameters are below unity throughout the period 1960-95, indicating that U.S. mortality is lower at older ages relative to younger ages when compared to the standard age pattern of mortality. Figure 2.2 shows that slope parameters from the Himes model for males did not begin to increase until 1977, whereas

parameters from the Medicare model increased steadily from 1960 to 1995. For females, slope parameters from the Himes model remained fairly constant over time, with the range between high and low values being only 0.056. Slope parameters for the Medicare model were only slightly higher than those in the Himes model from 1966 to 1970, after which they increased over time. Results reported by Himes and colleagues (1994) show slope parameters for other countries that tend to decline over time, though several countries showed increases in the age-slope of mortality as overall mortality declined. Results for the slope parameters for both males and females suggest that, after controlling for enrollment in Medicare, the age pattern of mortality increases more rapidly at older ages relative to younger ages, which supports this study's hypothesis.

Parameter estimates and standard errors for Medicare enrollment variables are in the middle and bottom panels of Table 2.3 for males and Table 2.4 for females. Out of twelve Medicare parameters (six that adjust the level and six that adjust the slope), all coefficients are negative for males, and all but two (both adjust the slope) are negative for females. Consistent with results for level and slope parameters, the overall pattern of these coefficients suggests that mortality conditions would have been more adverse if Medicare had not been introduced. All coefficients are significantly different from zero at the 5 percent level for males, and all but two coefficients are statistically significant for females. For both males and females there is a non-linear, negative relationship between mortality and duration of enrollment in Medicare. Coefficients for enrollment variables that adjust the level of mortality, $c(i)$, become more negative as duration of enrollment increases up to 15-20 years for both males and females, after which they decrease in size but remain negative. This

suggests that Medicare's influence on the level of mortality increases with duration of enrollment up to a threshold, then decreases. Coefficients for the variables that adjust the age-slope of mortality, $d(i)$, become more negative as duration of enrollment increases up to 15-20 years of enrollment for males. For females, the coefficient is positive and significant for less than five years of enrollment, but the coefficients are negative and increase in magnitude between 5-10 years and 15-20 years of enrollment, decrease for 20-25 years, then become positive for 25-30 years. The slope-adjustment coefficients for 20-25 and 25-30 years of enrollment are not statistically significant. These patterns suggest that Medicare may have reduced the rate of increase in mortality with age.

In summary, the patterns over time for level and slope parameters in the Himes model suggest that mortality would have been higher if Medicare had not been introduced. Adjusting for the duration of enrollment in Medicare results in higher estimated levels and steeper increases in mortality with age, with more pronounced changes associated with Medicare for females than for males. The association between duration of enrollment in Medicare and the level of mortality becomes more negative as duration increases from <5 years up to 15-20 years, after which there are diminishing returns to duration of enrollment. It should be noted that only persons aged 85 and older could have achieved 20 or more years of enrollment in Medicare by 1995, thus the weaker association between duration of enrollment and mortality is primarily among the oldest old. Medical care may have a smaller effect on mortality at the highest ages.

Predicted Death Rates

Predicted death rates at ages 65-99 for each year from 1966 to 1995 can be calculated from the estimated Himes and Medicare models. Predicted death rates that simulate conditions might have prevailed in the absence of Medicare are calculated by removing the Medicare parameters, $c(i)$ and $d(i)$, from the estimated Medicare model (equation 2.2). Figure 2.3 plots the difference between predicted death rates from the No Medicare model and the Medicare model, averaged over age, for each year from 1966 to 1995. Due to the manner in which duration of enrollment intervals are defined, the plots resemble step functions with pronounced discontinuities corresponding to cut points for the duration intervals. For males and females, deaths rates that simulate mortality conditions without Medicare are higher than death rates that approximate observed mortality conditions. Average differences between the two series range from 3 to 6 percent for males, with the differences being most pronounced between 1971 and 1985. For females, the differences increase from 7 percent for 1966-70 to 17 percent for 1971-75, 22 percent for 1976-80, and 25 percent for 1981-95.

Life Expectancy

Medicare's contribution to longevity can be seen more clearly by comparing differences in life expectancy at age 65 under the various mortality scenarios. Four sets of life expectancy estimates are compared: those based on observed mortality conditions, those based on the Himes model, those based on the Medicare model, and those based on the No Medicare model. These estimates are presented in Table 2.5 and Figure 2.4.

As the table and figure show, observed life expectancy at age 65 increased steadily over time, with males gaining 2.47 years and females gaining 2.68 years between 1966 and 1995. Estimates based on the Himes model overestimate observed life expectancy for males whereas they underestimate observed life expectancy for females. Absolute gains in longevity from the Himes model are slightly lower than observed for males (2.42 vs. 2.47 years) but are the same as observed for females (2.68 years). Life expectancy estimates based on the Medicare model more closely approximate observed trends in life expectancy than estimates derived from the Himes model. Nonetheless, increases in longevity from the Medicare model are slightly lower than observed gains (2.42 vs. 2.47 years for males; 2.65 vs. 2.68 years for females). The No Medicare produces estimates of life expectancy that are only slightly lower than from the Medicare model for males but are considerably lower for females. For males, life expectancy increases 2.37 years between 1966 and 1995 under mortality conditions without Medicare, only 0.05 year less than the increase predicted by the Medicare model. In other words, only 2 percent of the gains in longevity for U.S. males is attributable to Medicare. For females, simulated mortality conditions show an increase of only 1.11 years in life expectancy at age 65 in the absence of Medicare, which means that 58 percent (1.54 years) of the gain in longevity for U.S. females between 1966 and 1995 is attributable to Medicare.

Projections of the Older Population

Simulated trends in life expectancy suggest that Medicare has contributed to substantial improvements in mortality for females but only marginal gains for males.

Projections of the older population under observed and simulated mortality conditions can be used to assess the contribution of lower death rates under Medicare to the growth of the elderly population during the program's first three decades. Table 2.6 presents population estimates for ages 65 and older based on projections using observed death rates and the three sets of predicted death rates for ages 65-99 from 1966 to 1995. Figure 2.5 plots population estimates by sex for the Medicare and No Medicare models.

As the trends in life expectancy showed, the Medicare model closely reproduces observed mortality conditions. Since life table survival ratios used to survive the population forward in the projections are based on underlying death rates, population estimates based on the Medicare model are much closer to observed populations than those based on the Himes model. The older male population increased by 58.3 percent between 1966 and 1996 under observed mortality conditions, which is compared to the 58.4 percent increase predicted by the Medicare model. In the absence of Medicare, the older male population increased by 57.3 percent. In other words, of the projected increase of 4.647 million older males between 1966 and 1996 from the Medicare model, 1.7 percent (about 80,000 persons) is attributable to Medicare.

For females, the older female population increased by 81.5 between 1966 and 1996 under observed mortality conditions, which is slightly greater than the 81.3 percent increase predicted by the Medicare model. Without Medicare, the older female population would have increased by only 63.5 percent. Approximately 21.9 percent (1.853 million persons) of the projected increase in the number of older females between 1966 and 1996 is attributable to Medicare.

CONCLUSION

For over three decades Medicare has provided access to health care for nearly all Americans ages 65 and older by greatly reducing the financial burden of obtaining necessary medical treatment (Gornick et al. 1996; Moon 1993; Vladeck 1999). Results presented here suggest that some of the improvements in mortality at older ages are associated with Medicare, with a more pronounced benefit for females than for males. Simulations suggest that only 2 percent of the increase in male life expectancy at age 65 between 1966 and 1995 is attributable to Medicare, whereas 58 percent of the increase in female life expectancy at age 65 over the same period is attributable to the program. If Medicare contributed to lower mortality, then deaths were averted or delayed as a result of the program's influence on health status, which fueled growth of the elderly population. Using simulated mortality conditions to project the older population from 1966 to 1966 shows that only about 2 percent of the increase in the size of the older male population from 1966 to 1996 could be attributable to Medicare, whereas nearly 22 percent of the increase in the number of older females might be due to Medicare.

The much larger impact of Medicare on mortality among females is an unexpected result. Why did Medicare confer a 1.57-year increase in life expectancy at age 65 for females, but only a 0.10-year increase for males? Were women much heavier users of Medicare services than men? Conversely, why would life expectancy at age 65 continue to increase nearly unabated among males had Medicare not been introduced, whereas females would have experienced a gain of only about one year? Were there changes in non-medical risk factors since the late 1960s that would have benefitted males more than females?

A greater impact of Medicare-provided services on the health status of older females is consistent with sex-specific patterns of mortality, health service utilization, and health behavior. Although females report higher rates of illness and disability, they have lower death rates and higher life expectancy than males at every age (Zopf 1992). Death rates from cardiovascular disease decreased rapidly for both sexes after 1968, but more so for women than for men (Wingard 1984). Differentials in mortality by education have increased since 1960 for older males, but not for older females (Feldman, Makuc, Kleinman, and Cornoni-Huntley 1989; Preston and Elo 1995). Feldman and colleagues (1989) argue that, in addition to cohort-specific changes in childhood environments and cigarette smoking by educational groups, better educated men were more likely than less educated men to have access to high-quality medical and surgical treatments for heart disease because of educational differences in adherence, motivation, and life circumstances. The more rapid abandonment of smoking among males over the past several decades (Preston 1996) may also play a role in the apparent sex difference in the impact of Medicare.

In terms of health behavior, females visit physicians more often, take more prescription drugs, make greater use of medical facilities and personnel, and are more active in terms of preventive health care than males (Pol and Thomas 1992). Women more effectively control life-threatening conditions such as hypertension (Waldron 1986). Thus, females may have capitalized on the increased access to health care through Medicare more so than males. Although, in general, females consume more health care services than males, utilization of Medicare-covered services does not differ markedly by sex. Older females use more skilled nursing facility, home health agency, and physician services than older males,

but older males use more hospital and outpatient services than older females (Gornick et al. 1996).

Another possible explanation for the sex difference in the impact of Medicare is the proportionate increase in health care coverage that occurred when the program was introduced. Since health insurance in the U.S. has historically been and continues to be closely tied to employment, health insurance coverage may have been higher among males before Medicare was introduced, and thus the proportionate increase in health coverage would have been larger for females. However, national survey indicate that health insurance coverage was about the same for males and females prior to Medicare (Rice 1964), and enrollment in Medicare does not differ by sex. On the other hand, because poverty is higher among older females than older males, females are more likely to benefit from more comprehensive coverages of health care services through Medicaid.

Several limitations of this study should be noted. First, the lower estimated impact of Medicare on mortality among men could be due to problems with model specification. While the Medicare model (equation 2.2) fit observed mortality data very well for both males and females, the overall fit was better for females ($R^2 = 0.986$) than for males ($R^2=0.943$). When Medicare extended access in 1973 to persons with disabilities regardless of age, the vast majority of disabled enrollees less than 65 years of age were males (Gornick, Greenberg, Eggers, and Dobson 1985), yet this segment of the Medicare population is not represented by enrollment variables used in this study.

Second, improvements in mortality attributed to Medicare may be due in part to other programs specifically targeted at older adults. For instance, about 10-12 percent of the

elderly Medicare population is also covered by Medicaid, which pays for some health care services above and beyond those covered by the Medicare program, most notably nursing home and prescription drug expenses (Gornick et al. 1996). As part of state buy-in programs, Medicaid also pays the supplemental medical insurance (Part B) premiums for many low-income elders. To cover benefits not included in Medicare, most older adults have supplementary "medigap" coverage, which bolsters Medicare's apparent contribution to longevity. In addition to health care coverage, Social Security provides income for most older adults, with an inflation-adjusted minimum level of benefits in place since the early 1970s. Enrollment in Medicare overlaps with Medicaid, medigap coverage, and Social Security for many older adults, but the specification of enrollment in Medicare as used in this study cannot distinguish between these various programs, all of which may have contributed to better health and lower mortality at older ages.

In general, the results of this study are consistent with earlier claims that Medicare has contributed to the increases in longevity among older Americans observed over the last several decades. Improvements in survivorship have not, however, merely extend the lives of Americans suffering from chronic morbidities and disabilities. Though there were significant increases in disability between 1970 and 1980 among noninstitutionalized adults aged 65-74, there were no significant changes in the prevalence of disability among men and women aged 75+ over the period 1970-90 (Crimmins, Saito, and Igegneri 1997). Manton, Stallard, and Corder (1995) find that prevalence rates for basic and instrumental ADL (activities of daily living) limitations declined within the elderly population between 1982 and 1989. Furthermore, there were significant decreases for the total elderly

noninstitutionalized population in the prevalence of arthritis, arteriosclerosis, dementia, hypertension, stroke, circulatory disease, and emphysema. Thus, Medicare appears to have extended not only the length of life, but also its quality.

TABLE 2.1 Estimates from the Himes Model, Males Ages 45-99, 1960-1995

Parameter	Estimate	Standard Error†	Parameter	Estimate	Standard Error	Parameter	Estimate	Standard Error
				Level Parameters				
a(1960)	-0.3777	0.0113	a(1972)	-0.4283	0.0113	a(1984)	-0.5623	0.0113
a(1961)	-0.3782	0.0113	a(1973)	-0.4149	0.0113	a(1985)	-0.5310	0.0113
a(1962)	-0.3214	0.0113	a(1974)	-0.4913	0.0113	a(1986)	-0.5588	0.0113
a(1963)	-0.2764	0.0113	a(1975)	-0.5419	0.0113	a(1987)	-0.5897	0.0113
a(1964)	-0.3652	0.0113	a(1976)	-0.4914	0.0113	a(1988)	-0.4693	0.0113
a(1965)	-0.3368	0.0113	a(1977)	-0.5457	0.0113	a(1989)	-0.5391	0.0113
a(1966)	-0.3467	0.0113	a(1978)	-0.5406	0.0113	a(1990)	-0.5486	0.0113
a(1967)	-0.3947	0.0113	a(1979)	-0.5905	0.0113	a(1991)	-0.5809	0.0113
a(1968)	-0.3068	0.0113	a(1980)	-0.5289	0.0113	a(1992)	-0.5735	0.0113
a(1969)	-0.3831	0.0113	a(1981)	-0.5790	0.0113	a(1993)	-0.5287	0.0113
a(1970)	-0.4527	0.0113	a(1982)	-0.6357	0.0113	a(1994)	-0.5330	0.0113
a(1971)	-0.4280	0.0113	a(1983)	-0.5698	0.0113	a(1995)	-0.5260	0.0113
				Slope Parameters				
b(1960)	0.8506	0.0036	b(1972)	0.8471	0.0036	b(1984)	0.8824	0.0036
b(1961)	0.8581	0.0036	b(1973)	0.8561	0.0036	b(1985)	0.8915	0.0036
b(1962)	0.8683	0.0036	b(1974)	0.8465	0.0036	b(1986)	0.8895	0.0036
b(1963)	0.8745	0.0036	b(1975)	0.8430	0.0036	b(1987)	0.8850	0.0036
b(1964)	0.8571	0.0036	b(1976)	0.8611	0.0036	b(1988)	0.9180	0.0036
b(1965)	0.8628	0.0036	b(1977)	0.8541	0.0036	b(1989)	0.9063	0.0036
b(1966)	0.8576	0.0036	b(1978)	0.8594	0.0036	b(1990)	0.9100	0.0036
b(1967)	0.8499	0.0036	b(1979)	0.8550	0.0036	b(1991)	0.9050	0.0036
b(1968)	0.8623	0.0036	b(1980)	0.8706	0.0036	b(1992)	0.9116	0.0036
b(1969)	0.8528	0.0036	b(1981)	0.8640	0.0036	b(1993)	0.9207	0.0036
b(1970)	0.8379	0.0036	b(1982)	0.8576	0.0036	b(1994)	0.9236	0.0036
b(1971)	0.8487	0.0036	b(1983)	0.8762	0.0036	b(1995)	0.9275	0.0036

NOTE: For each year t, the model has a level [$a(t)$] and a slope [$b(t)$] parameter. See text for more details.
†Asymptotic standard error.

TABLE 2.2 Estimates from the Himes Model, Females Ages 45-99, 1960-1995

Parameter	Estimate	Standard Error†	Parameter	Estimate	Standard Error	Parameter	Estimate	Standard Error
				Level Parameters				
a(1960)	-0.2958	0.0159	a(1972)	-0.5519	0.0159	a(1984)	-0.7557	0.0159
a(1961)	-0.3106	0.0159	a(1973)	-0.5580	0.0159	a(1985)	-0.7262	0.0159
a(1962)	-0.2643	0.0159	a(1974)	-0.6207	0.0159	a(1986)	-0.7363	0.0159
a(1963)	-0.2522	0.0159	a(1975)	-0.6907	0.0159	a(1987)	-0.7437	0.0159
a(1964)	-0.3300	0.0159	a(1976)	-0.6615	0.0159	a(1988)	-0.6950	0.0159
a(1965)	-0.3368	0.0159	a(1977)	-0.7219	0.0159	a(1989)	-0.7366	0.0159
a(1966)	-0.3471	0.0159	a(1978)	-0.6790	0.0159	a(1990)	-0.7699	0.0159
a(1967)	-0.4173	0.0159	a(1979)	-0.7640	0.0159	a(1991)	-0.7939	0.0159
a(1968)	-0.4089	0.0159	a(1980)	-0.6974	0.0159	a(1992)	-0.8112	0.0159
a(1969)	-0.4830	0.0159	a(1981)	-0.7473	0.0159	a(1993)	-0.7409	0.0159
a(1970)	-0.5634	0.0159	a(1982)	-0.8177	0.0159	a(1994)	-0.7498	0.0159
a(1971)	-0.5450	0.0159	a(1983)	-0.7540	0.0159	a(1995)	-0.7313	0.0159
				Slope Parameters				
b(1960)	0.8936	0.0044	b(1972)	0.8620	0.0044	b(1984)	0.8652	0.0044
b(1961)	0.8972	0.0044	b(1973)	0.8642	0.0044	b(1985)	0.8722	0.0044
b(1962)	0.9052	0.0044	b(1974)	0.8594	0.0044	b(1986)	0.8726	0.0044
b(1963)	0.9058	0.0044	b(1975)	0.8525	0.0044	b(1987)	0.8728	0.0044
b(1964)	0.8936	0.0044	b(1976)	0.8628	0.0044	b(1988)	0.8844	0.0044
b(1965)	0.8933	0.0044	b(1977)	0.8550	0.0044	b(1989)	0.8809	0.0044
b(1966)	0.8913	0.0044	b(1978)	0.8672	0.0044	b(1990)	0.8765	0.0044
b(1967)	0.8803	0.0044	b(1979)	0.8563	0.0044	b(1991)	0.8729	0.0044
b(1968)	0.8793	0.0044	b(1980)	0.8674	0.0044	b(1992)	0.8732	0.0044
b(1969)	0.8700	0.0044	b(1981)	0.8602	0.0044	b(1993)	0.8853	0.0044
b(1970)	0.8535	0.0044	b(1982)	0.8497	0.0044	b(1994)	0.8853	0.0044
b(1971)	0.8614	0.0044	b(1983)	0.8634	0.0044	b(1995)	0.8901	0.0044

NOTE: For each year t, the model has a level [$a(t)$] and a slope [$b(t)$] parameter. See text for more details.
†Asymptotic standard error.

TABLE 2.3 Estimates from the Medicare Model, Males Ages 45-99, 1960-1995

Parameter	Estimate	Standard Error†	Parameter	Estimate	Standard Error	Parameter	Estimate	Standard Error
Level Parameters								
a(1960)	-0.3777	0.0079	a(1972)	-0.2802	0.0079	a(1984)	-0.3559	0.0079
a(1961)	-0.3782	0.0079	a(1973)	-0.2667	0.0079	a(1985)	-0.3246	0.0079
a(1962)	-0.3214	0.0079	a(1974)	-0.3431	0.0079	a(1986)	-0.4270	0.0079
a(1963)	-0.2764	0.0079	a(1975)	-0.3938	0.0079	a(1987)	-0.4578	0.0079
a(1964)	-0.3652	0.0079	a(1976)	-0.3177	0.0079	a(1988)	-0.3374	0.0079
a(1965)	-0.3368	0.0079	a(1977)	-0.3720	0.0079	a(1989)	-0.4073	0.0079
a(1966)	-0.2700	0.0079	a(1978)	-0.3669	0.0079	a(1990)	-0.4167	0.0079
a(1967)	-0.3180	0.0079	a(1979)	-0.4168	0.0079	a(1991)	-0.4979	0.0079
a(1968)	-0.2300	0.0079	a(1980)	-0.3552	0.0079	a(1992)	-0.4905	0.0079
a(1969)	-0.3064	0.0079	a(1981)	-0.3726	0.0079	a(1993)	-0.4457	0.0079
a(1970)	-0.3759	0.0079	a(1982)	-0.4293	0.0079	a(1994)	-0.4500	0.0079
a(1971)	-0.2798	0.0079	a(1983)	-0.3634	0.0079	a(1995)	-0.4429	0.0079
Medicare Enrollment Parameters which Adjust the Level								
c(<5)	-0.0934	0.0169	c(10-15)	-0.2318	0.0137	c(20-25)	-0.2034	0.0128
c(5-10)	-0.1851	0.0148	c(15-20)	-0.3066	0.0130	c(25-30)	-0.1053	0.0129
Slope Parameters								
b(1960)	0.8506	0.0025	b(1972)	0.8833	0.0025	b(1984)	0.9346	0.0025
b(1961)	0.8581	0.0025	b(1973)	0.8923	0.0025	b(1985)	0.9437	0.0025
b(1962)	0.8683	0.0025	b(1974)	0.8827	0.0025	b(1986)	0.9227	0.0025
b(1963)	0.8745	0.0025	b(1975)	0.8792	0.0025	b(1987)	0.9182	0.0025
b(1964)	0.8571	0.0025	b(1976)	0.9042	0.0025	b(1988)	0.9512	0.0025
b(1965)	0.8628	0.0025	b(1977)	0.8973	0.0025	b(1989)	0.9395	0.0025
b(1966)	0.8783	0.0025	b(1978)	0.9025	0.0025	b(1990)	0.9432	0.0025
b(1967)	0.8686	0.0025	b(1979)	0.8981	0.0025	b(1991)	0.9253	0.0025
b(1968)	0.8849	0.0025	b(1980)	0.9137	0.0025	b(1992)	0.9319	0.0025
b(1969)	0.8715	0.0025	b(1981)	0.9161	0.0025	b(1993)	0.9410	0.0025
b(1970)	0.8566	0.0025	b(1982)	0.9098	0.0025	b(1994)	0.9439	0.0025
b(1971)	0.8849	0.0025	b(1983)	0.9284	0.0025	b(1995)	0.9478	0.0025
Medicare Enrollment Parameters which Adjust the Slope								
d(<5)	-0.0305	0.0047	d(10-15)	-0.0902	0.0047	d(20-25)	-0.1168	0.0070
d(5-10)	-0.0636	0.0045	d(15-20)	-0.1472	0.0053	d(25-30)	-0.0485	0.0129

NOTE: For each year t, the model has a level parameter [$a(t)$], a slope parameter [$b(t)$], and parameters for variables which represent duration of enrollment in Medicare [$c(i)$ and $d(i)$]. See text for more details.

†Asymptotic standard error.

TABLE 2.4 Estimates from the Medicare Model: Females Ages 45-99, 1960-1995

Parameter	Estimate	Standard Error†	Parameter	Estimate	Standard Error	Parameter	Estimate	Standard Error
Level Parameters								
a(1960)	-0.2958	0.0098	a(1972)	-0.2160	0.0098	a(1984)	-0.1755	0.0098
a(1961)	-0.3106	0.0098	a(1973)	-0.2220	0.0098	a(1985)	-0.1459	0.0098
a(1962)	-0.2643	0.0098	a(1974)	-0.2847	0.0098	a(1986)	-0.1739	0.0098
a(1963)	-0.2522	0.0098	a(1975)	-0.3548	0.0098	a(1987)	-0.1812	0.0098
a(1964)	-0.3300	0.0098	a(1976)	-0.1988	0.0098	a(1988)	-0.1325	0.0098
a(1965)	-0.3368	0.0098	a(1977)	-0.2592	0.0098	a(1989)	-0.1742	0.0098
a(1966)	-0.2553	0.0098	a(1978)	-0.2163	0.0098	a(1990)	-0.2075	0.0098
a(1967)	-0.3255	0.0098	a(1979)	-0.3012	0.0098	a(1991)	-0.2314	0.0098
a(1968)	-0.3172	0.0098	a(1980)	-0.2347	0.0098	a(1992)	-0.2487	0.0098
a(1969)	-0.3913	0.0098	a(1981)	-0.1670	0.0098	a(1993)	-0.1784	0.0098
a(1970)	-0.4717	0.0098	a(1982)	-0.2375	0.0098	a(1994)	-0.1873	0.0098
a(1971)	-0.2091	0.0098	a(1983)	-0.1737	0.0098	a(1995)	-0.1688	0.0098
Medicare Enrollment Parameters which Adjust the Level								
c(<5)	-0.0517	0.0240	c(10-15)	-0.3834	0.0191	c(20-25)	-0.4678	0.0183
c(5-10)	-0.2811	0.0207	c(15-20)	-0.5170	0.0184	c(25-30)	-0.4621	0.0191
Slope Parameters								
b(1960)	0.8936	0.0027	b(1972)	0.9229	0.0027	b(1984)	0.9765	0.0027
b(1961)	0.8972	0.0027	b(1973)	0.9251	0.0027	b(1985)	0.9835	0.0027
b(1962)	0.9052	0.0027	b(1974)	0.9203	0.0027	b(1986)	0.9797	0.0027
b(1963)	0.9058	0.0027	b(1975)	0.9134	0.0027	b(1987)	0.9799	0.0027
b(1964)	0.8936	0.0027	b(1976)	0.9489	0.0027	b(1988)	0.9915	0.0027
b(1965)	0.8933	0.0027	b(1977)	0.9410	0.0027	b(1989)	0.9880	0.0027
b(1966)	0.9047	0.0027	b(1978)	0.9533	0.0027	b(1990)	0.9836	0.0027
b(1967)	0.8937	0.0027	b(1979)	0.9423	0.0027	b(1991)	0.9800	0.0027
b(1968)	0.8927	0.0027	b(1980)	0.9535	0.0027	b(1992)	0.9803	0.0027
b(1969)	0.8834	0.0027	b(1981)	0.9715	0.0027	b(1993)	0.9924	0.0027
b(1970)	0.8669	0.0027	b(1982)	0.9610	0.0027	b(1994)	0.9924	0.0027
b(1971)	0.9223	0.0027	b(1983)	0.9747	0.0027	b(1995)	0.9972	0.0027
Medicare Enrollment Parameters which Adjust the Slope								
d(<5)	0.0123	0.0056	d(10-15)	-0.0202	0.0054	d(20-25)	-0.0090	0.0082
d(5-10)	-0.0206	0.0053	d(15-20)	-0.0466	0.0061	d(25-30)	0.0019	0.0154

NOTE: For each year t, the model has a level parameter [$a(t)$], a slope parameter [$b(t)$], and parameters for variables which represent duration of enrollment in Medicare [$c(i)$ and $d(i)$]. See text for more details.

†Asymptotic standard error.

TABLE 2.5 Life Expectancy at Age 65 for Under Observed and Simulated Mortality Conditions, Males and Females, 1966-1995

	Males				Females			
		Simulated				Simulated		
Year	Observed	Himes Model	Medicare Model	No Medicare Model	Observed	Himes Model	Medicare Model	No Medicare Model
1966	12.86	12.87	12.78	12.69	16.32	16.12	16.33	15.75
1967	13.01	13.06	12.97	12.87	16.58	16.39	16.60	16.02
1968	12.80	12.76	12.66	12.57	16.60	16.32	16.52	15.94
1969	13.02	13.03	12.94	12.84	16.90	16.65	16.86	16.27
1970	13.14	13.25	13.15	13.05	17.11	16.90	17.11	16.52
1971	13.13	13.27	13.07	12.90	17.14	16.93	17.16	15.77
1972	13.09	13.24	13.05	12.87	17.18	16.99	17.22	15.83
1973	13.19	13.30	13.11	12.94	17.35	17.07	17.30	15.91
1974	13.48	13.66	13.47	13.28	17.66	17.43	17.66	16.24
1975	13.70	13.95	13.76	13.56	18.02	17.80	18.03	16.59
1976	13.75	13.92	13.66	13.48	18.08	17.79	18.03	16.19
1977	13.91	14.17	13.92	13.72	18.33	18.08	18.32	16.45
1978	13.95	14.23	13.97	13.78	18.33	18.00	18.23	16.39
1979	14.18	14.50	14.25	14.04	18.60	18.41	18.65	16.76
1980	14.04	14.34	14.09	13.89	18.35	18.13	18.37	16.52
1981	14.24	14.58	14.23	14.05	18.58	18.36	18.49	16.40
1982	14.45	14.87	14.53	14.33	18.80	18.69	18.82	16.67
1983	14.31	14.73	14.38	14.19	18.63	18.47	18.61	16.50
1984	14.41	14.78	14.44	14.25	18.66	18.52	18.65	16.54
1985	14.39	14.72	14.38	14.19	18.62	18.43	18.57	16.47
1986	14.51	14.88	14.67	14.53	18.66	18.52	18.69	16.59
1987	14.64	15.02	14.81	14.67	18.73	18.57	18.75	16.64
1988	14.56	14.74	14.54	14.40	18.66	18.43	18.61	16.53
1989	14.84	15.03	14.82	14.68	18.87	18.67	18.85	16.74
1990	14.98	15.16	14.95	14.81	19.02	18.83	19.01	16.88
1991	15.12	15.30	15.20	15.06	19.13	18.94	19.13	16.97
1992	15.21	15.36	15.26	15.12	19.20	19.08	19.26	17.09
1993	15.08	15.20	15.10	14.97	18.96	18.78	18.97	16.84
1994	15.28	15.28	15.18	15.05	19.03	18.85	19.03	16.90
1995	15.33	15.30	15.20	15.06	19.00	18.80	18.98	16.86
Increase	2.47	2.43	2.42	2.37	2.68	2.68	2.65	1.11

TABLE 2.6 Projection of Population Aged 65+ Under Observed and Simulated Mortality Conditions, Males and Females, 1966-1995

Year	Males				Females			
		Simulated				Simulated		
	Observed	Himes Model	Medicare Model	No Medicare Model	Observed	Himes Model	Medicare Model	No Medicare Model
1966	7.952	7.952	7.952	7.952	10.417	10.417	10.417	10.417
1967	7.995	7.995	7.989	7.979	10.605	10.591	10.604	10.563
1968	8.094	8.097	8.085	8.067	10.863	10.837	10.862	10.784
1969	8.163	8.161	8.143	8.118	11.092	11.050	11.086	10.973
1970	8.267	8.266	8.244	8.212	11.368	11.312	11.360	11.214
1971	8.391	8.398	8.372	8.334	11.668	11.602	11.661	11.485
1972	8.489	8.507	8.469	8.418	11.935	11.860	11.932	11.657
1973	8.605	8.633	8.584	8.523	12.222	12.137	12.223	11.856
1974	8.721	8.755	8.697	8.625	12.509	12.411	12.508	12.058
1975	8.868	8.912	8.846	8.767	12.818	12.710	12.818	12.293
1976	9.044	9.102	9.028	8.942	13.171	13.054	13.172	12.580
1977	9.195	9.260	9.173	9.082	13.483	13.351	13.481	12.785
1978	9.386	9.464	9.365	9.269	13.856	13.712	13.854	13.066
1979	9.568	9.660	9.550	9.451	14.196	14.034	14.186	13.312
1980	9.782	9.890	9.771	9.669	14.574	14.407	14.567	13.616
1981	9.950	10.072	9.943	9.838	14.891	14.715	14.884	13.861
1982	10.111	10.249	10.104	9.998	15.201	15.019	15.188	14.070
1983	10.304	10.462	10.303	10.196	15.535	15.354	15.523	14.321
1984	10.499	10.677	10.505	10.396	15.877	15.694	15.862	14.582
1985	10.698	10.890	10.706	10.597	16.205	16.022	16.189	14.838
1986	10.907	11.109	10.913	10.803	16.535	16.350	16.514	15.098
1987	11.131	11.346	11.150	11.047	16.877	16.691	16.857	15.384
1988	11.328	11.557	11.362	11.262	17.181	16.996	17.162	15.636
1989	11.508	11.731	11.537	11.442	17.469	17.278	17.445	15.870
1990	11.727	11.945	11.753	11.660	17.782	17.589	17.755	16.136
1991	11.916	12.128	11.938	11.846	18.060	17.866	18.033	16.371
1992	12.076	12.284	12.105	12.016	18.298	18.103	18.270	16.566
1993	12.245	12.446	12.277	12.189	18.532	18.342	18.509	16.765
1994	12.363	12.553	12.394	12.307	18.674	18.484	18.652	16.870
1995	12.489	12.661	12.511	12.423	18.812	18.623	18.790	16.972
1996	12.590	12.740	12.599	12.510	18.905	18.714	18.882	17.029
Increase	4.638	4.788	4.647	4.558	8.487	8.297	8.465	6.611

NOTE: Populations shown in table are in millions.

FIGURE 2.1 Level Parameters from Himes and Medicare Models, Males and Females, 1960-1995

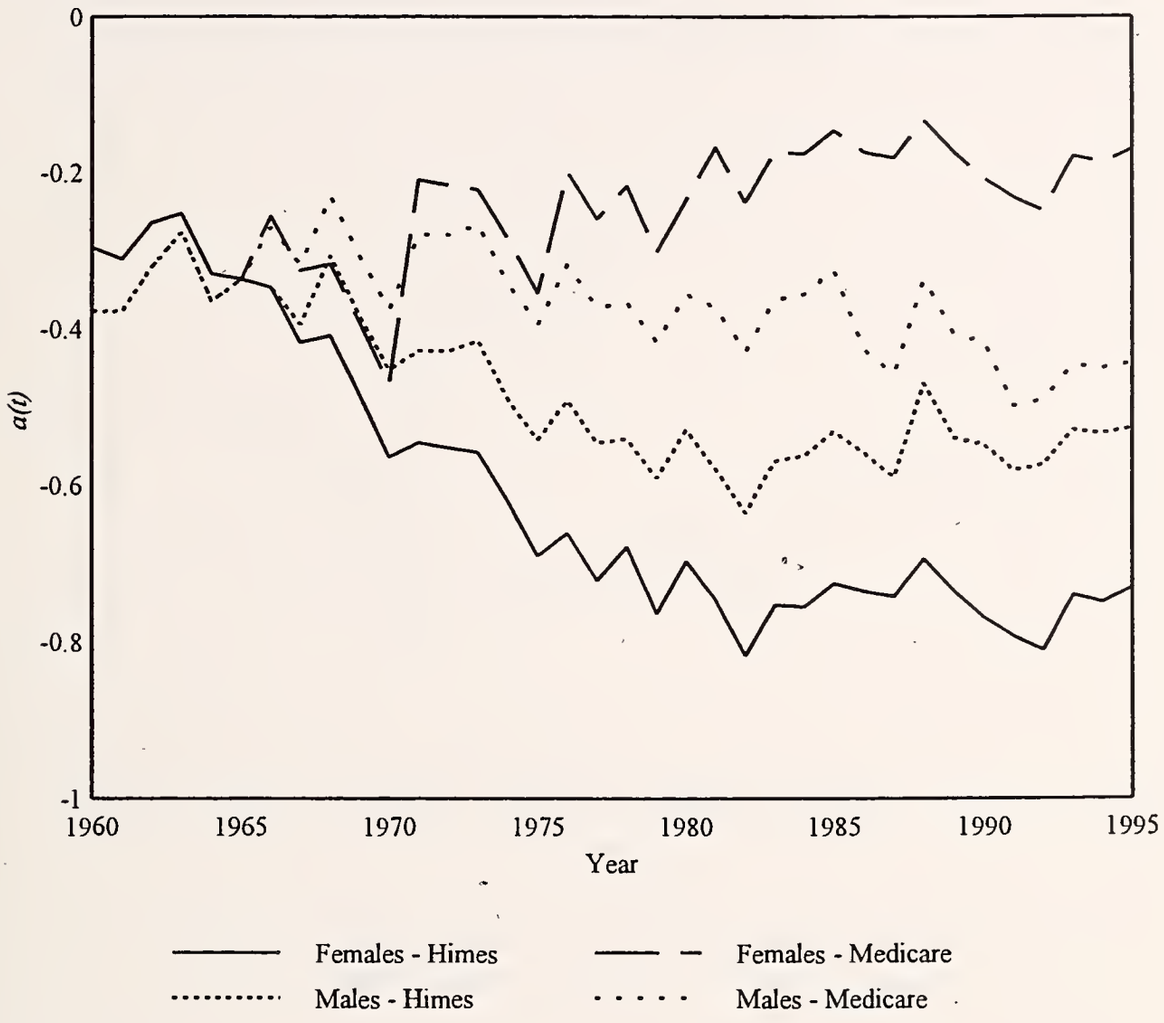


FIGURE 2.2 Slope Parameters from Himes and Medicare Models, Males and Females, 1960-1995

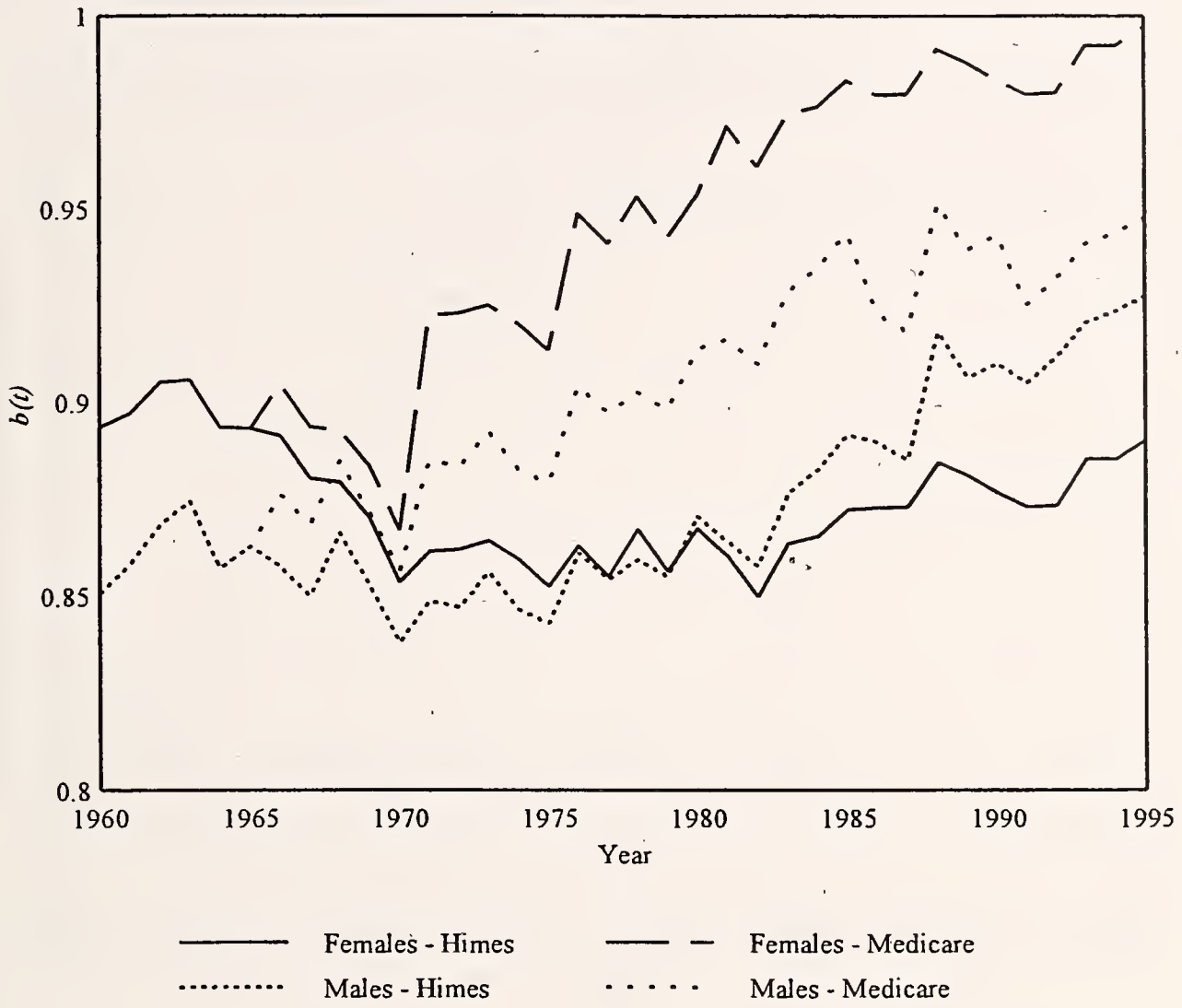


FIGURE 2.3 Average Annual Difference in Predicted Death Rates from No Medicare and Medicare Models, Males and Females, 1966-1995

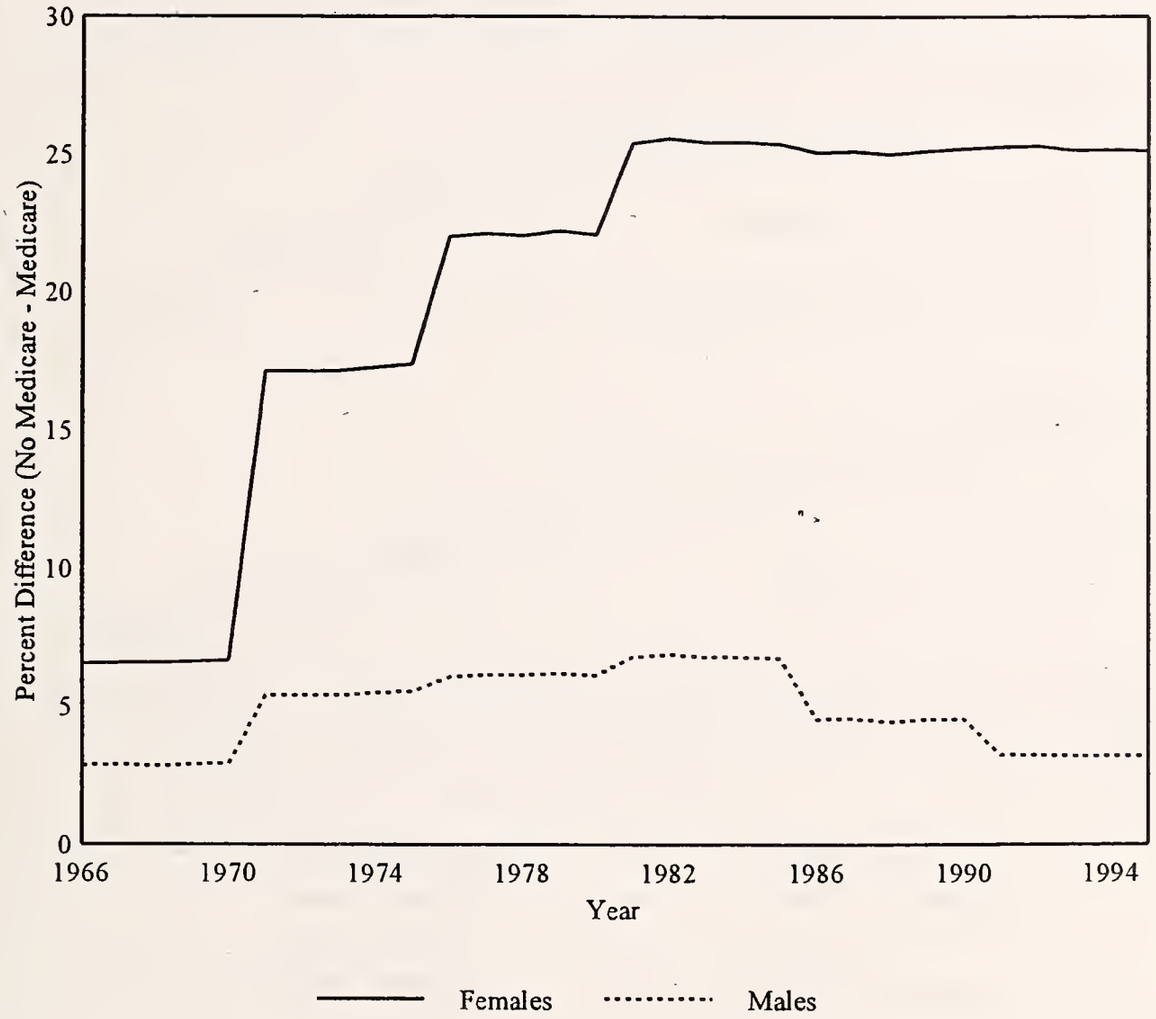
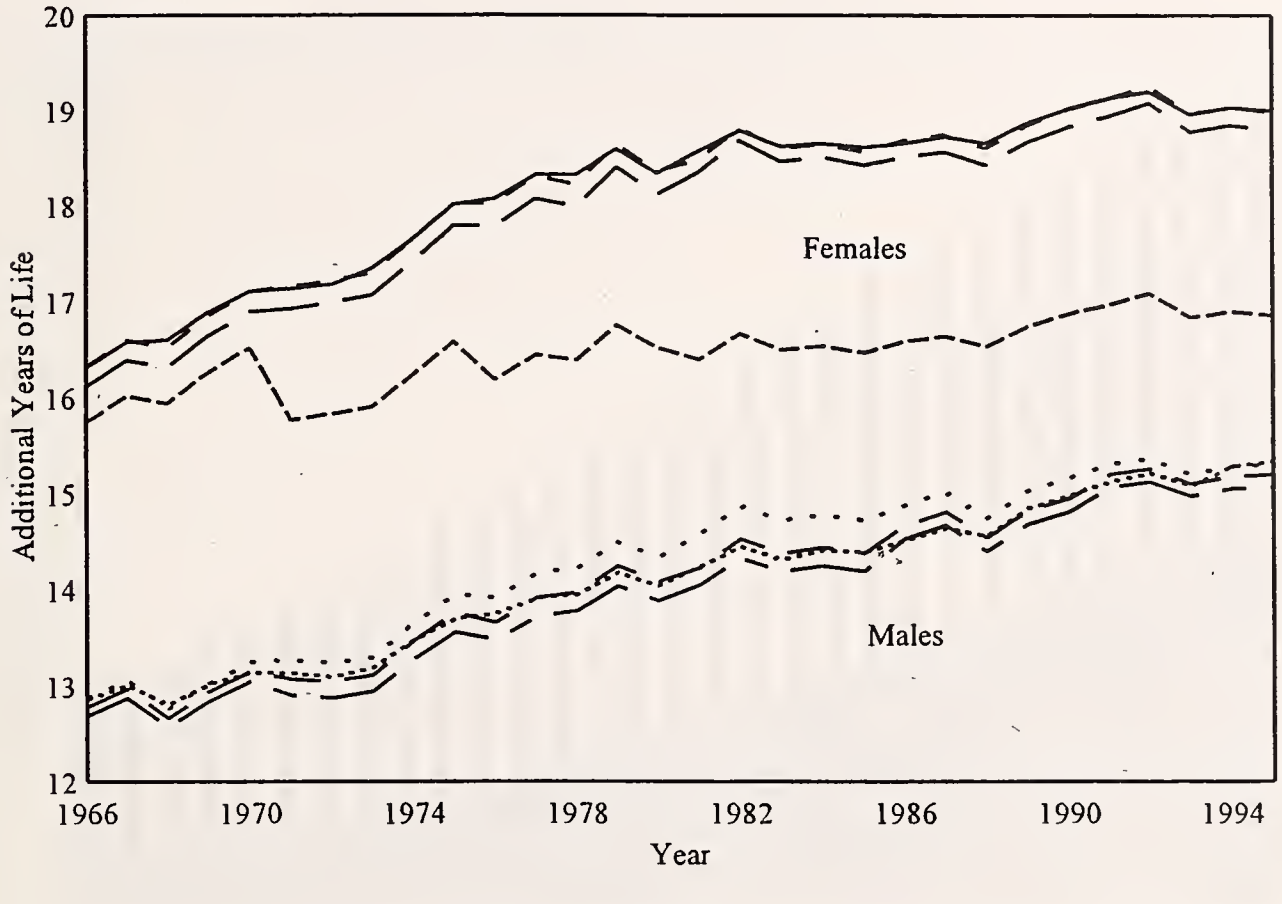
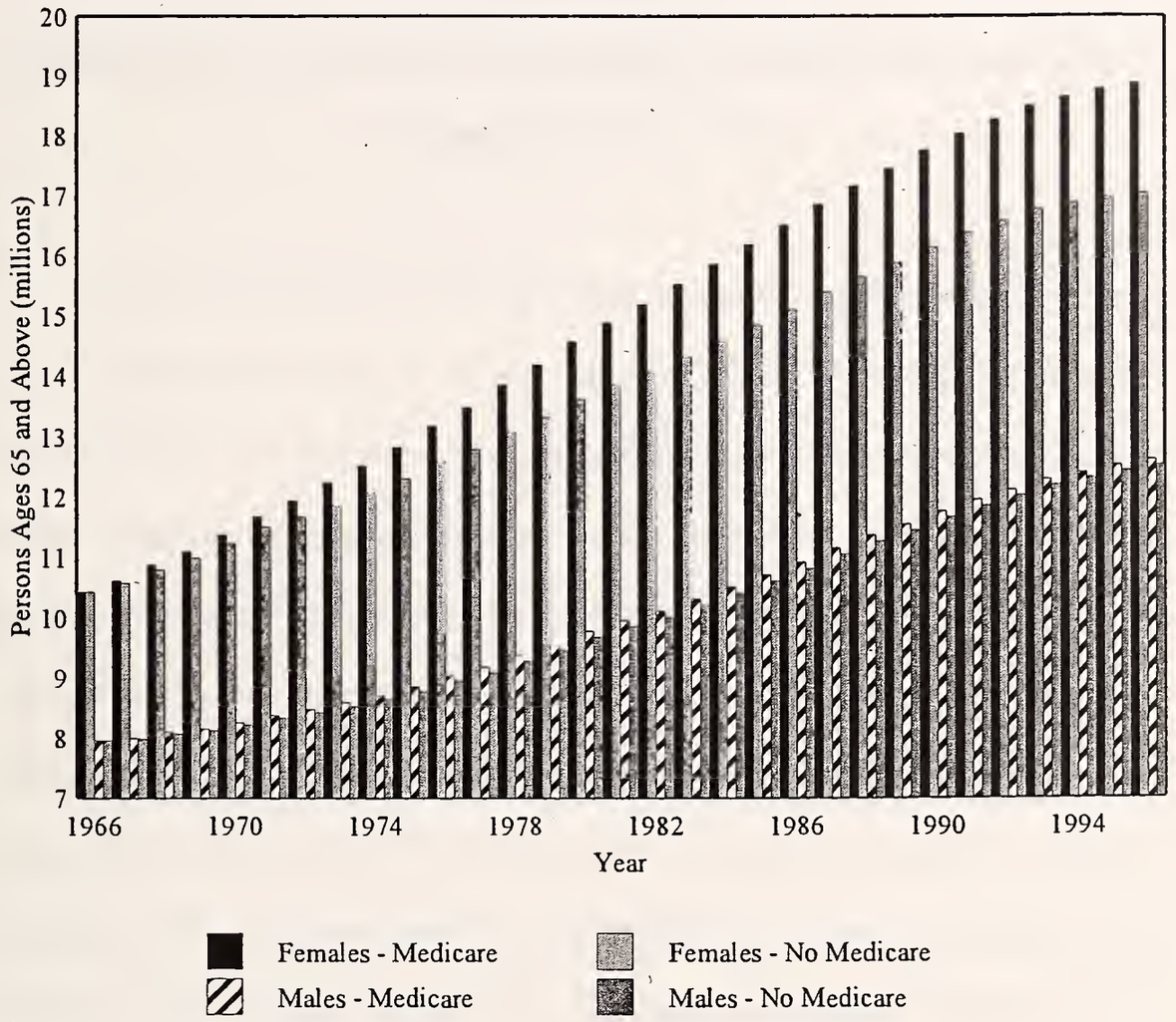


FIGURE 2.4 Life Expectancy at Age 65 Under Observed and Predicted Mortality Conditions, Males and Females, 1966-1995



———	Females - Observed	—— —	Females - Himes
— — —	Females - Medicare	———	Females - No Medicare
·····	Males - Observed	· · · · · ·	Males - Himes
—— ——	Males - Medicare	——— -	Males - No Medicare

FIGURE 2.5 Projection of the Population Aged 65+ Based on Mortality Conditions Predicted by Medicare and No Medicare Models, Males and Females, 1960-1995



CHAPTER 3

Demographic Consequences of Cause-Specific Mortality Change Since 1960: An Analysis by Race and Sex

Life expectancy at birth in the United States increased from 47.3 years in 1900 to 76.7 years in 1998 (National Center for Health Statistics [NCHS] 2000:1; U.S. Bureau of the Census 1975). The 30-year increase in longevity during the twentieth century has had a profound impact on the structure of the present-day population. Had mortality conditions present in 1900 prevailed throughout the entire century, half of the American population would not be alive today: one quarter would have been born and died, while another quarter would never have been born because their female ancestors would not have survived to reproduce (White and Preston 1996). This simple, yet remarkable result was achieved by projecting the U.S. population from 1900 to 2000 while holding death rates constant at their 1900 levels. The demographic impact of mortality decline during the twentieth century was assessed by way of difference between the population projected under hypothetical, fixed-mortality conditions and the actual population in 2000. The authors allowed fertility and migration rates to change as they did in the actual population, thus their results estimate first-order effects of mortality decline.

Counterfactual population projections can serve as insightful heuristic devices by formally demonstrating the implications of various demographic scenarios. Coale (1956) compares two Swedish stable populations based on vital rates held constant at 1900 and 1950

levels to assess the effects of changes in fertility and mortality on age composition. Heuveline (1997) shows the world population in 2000 to be 34 percent larger than it would have been without mortality declines since 1950-55, whereas the current global population is 34 percent smaller than it would have been if not for fertility declines since mid-century. In other words, the effects of mortality and fertility decline since 1950-55 offset one another in terms of global population growth. Hermalin (1966) finds a similar result in his counterfactual projections of the U.S. population from 1900 to 1960. Observed mortality declines during this period resulted in a female population 25 percent larger in 1960 than would have existed if 1900 mortality conditions had remained constant. The gain roughly equals the loss of population due to fertility declines over the same period. In a second set of projections from 1960 to 2000, Hermalin shows the difference between the sizes of two female populations in 2000 under assumptions of constant and rapidly declining mortality to be only 4 percent. Contrary to the results for 1900-60, the failure of improvements in mortality from 1960 onwards to produce substantial population growth is attributed to the high probability of survival to reproductive age already achieved by 1960.

White (1999) extends the counterfactual projection approach by contrasting the impact of mortality decline from two leading causes of death: tuberculosis and cardiovascular disease. The U.S. population in 2000 was projected to be 13 percent larger than it would have been had tuberculosis death rates remained at 1900 levels, whereas the gain in population from declines in cardiovascular disease mortality since 1940 was only 6 percent. There is a striking contrast between the effects of mortality decline for these two causes on the age distribution of the population: the proportion of the population that is alive because

of declines in tuberculosis mortality is fairly evenly distributed over age, while deaths prevented because of declines in cardiovascular disease mortality have been concentrated at older ages. Only 2 percent of persons below age 65 are alive in 2000 as a result of declines in cardiovascular disease mortality since 1940, but 43 percent of persons at ages 65 and older owe their survival to declines from this cause of death. Although there has been a greater impact of lower tuberculosis mortality on total population growth, declines in cardiovascular disease mortality have prevented more deaths because this condition primarily affects adults at older ages where most deaths are concentrated.

This study expands the work of White (1999) by examining the effects of mortality change for a larger number of causes of death. Focusing on the period from 1960 to 2000, this study assesses the demographic consequences of mortality change for causes for which death rates have declined substantially, such as tuberculosis and cardiovascular disease, as well as for causes for which mortality has fluctuated or even increased over time, such as lung cancer. Furthermore, whereas previous studies have examined the total or female-only population, this chapter investigates the effects of mortality change separately by sex for white and black Americans. As the following review of U.S. mortality trends bears out, mortality experience during the twentieth century varied greatly along the axes of race and sex.

U.S. MORTALITY DECLINE DURING THE TWENTIETH CENTURY

Decomposition of increases in U.S. life expectancy during the twentieth century by race, sex, and time reveals several key insights. The pace and magnitude of increases in

longevity between 1900 and 1998 were not distributed evenly over the course of the century, nor were they equal across segments of the population. Table 3.1 summarizes trends in life expectancy at birth by race and sex at three points in time–1900, 1960, and 1998 (the most recent year for which data are available). Considering change over time, roughly 75 to 80 percent of gains in life expectancy between 1900 and 1998 occurred before 1960. Substantial gains in life expectancy realized during the first six decades of the twentieth century are primarily attributable to the abatement of infectious disease mortality. Striking primarily infants and children, high mortality from infectious and parasitic diseases early in the century greatly diminished the average length of life. Acceptance of the germ theory of disease provided the scientific foundation for campaigns to improve personal hygiene and advancements in public health which contributed to lower mortality (Condran and Preston 1994; Ewbank and Preston 1990; Preston 1996). In addition to these preventive measures, the discovery of sulfa drugs and antibiotics in the 1930s and 1940s provided effective treatments for infectious diseases (McKinlay, McKinlay, and Beaglehold 1989). After World War II, medical technology evolved rapidly as a result of the U.S. government's generous funding for biomedical research and the expansion of health care infrastructure (Somers and Somers 1977).

Since 1950, infectious diseases have been replaced by chronic, degenerative diseases as the leading causes of death. These diseases typically afflict middle-aged and older adults, thus deaths prevented as a result of lower mortality from these causes contribute fewer additional years to life expectancy at birth than the eradication of childhood infectious diseases. Following the substantial mortality declines during the first half of the century, a

stagnant period of mortality decline during the 1950s and 1960s led many experts to proclaim that the major improvements in mortality had already been made (Preston 1996). The validity of this argument was based on the realization that chronic diseases are generally less amenable than infectious diseases to specific medical interventions (e.g., antibiotics and immunizations). Although gains in life expectancy have slowed since 1960, as Table 3.1 shows, Lee and Carter (1992) provide compelling evidence that the average pace of decline for age-specific death rates was nearly constant throughout the twentieth century. Based on an analysis of U.S. mortality decline between 1940 and 1977, Crimmins (1981) also finds that most age groups exhibit similar patterns of mortality change in response to period fluctuations: when mortality declined rapidly (as was the case in 1940-54 and 1968-77) it tended to do so at all ages, and when mortality declined slowly (1954-68) all age groups were similarly affected.

The rising tide of longevity does lift all boats, but not necessarily to an equal degree. A dominant feature of twentieth century U.S. mortality patterns was the widening of the sex differential in life expectancy. As Table 3.1 shows, the female advantage in life expectancy among whites increased from only 2.1 years in 1900 to 6.7 years by 1960. In 1900, black females could expect to live only one additional year over their male counterparts, but the gap grew to 5.2 years by 1960. During the anomalous period of 1954-68, when the secular decline in mortality slowed down, death rates continued to improve for females but they increased at most ages above 15 for black and white men (Crimmins 1981; NCHS 1971). Despite the upturn in mortality among males during much of the 1960s, white males gained 7.1 years in life expectancy between 1960 and 1998 versus 5.9 years for white females. The

attenuation of the sex difference in life expectancy among whites (from 6.7 years in 1960 to 5.5 years in 1998) has been attributed to more rapid abandonment of smoking by men (Preston 1996). This line of reasoning does not hold for blacks, however, as the female advantage in life expectancy for this group continued to widen through the end of the twentieth century (from 5.2 years in 1960 to 7.2 years in 1998). The continued widening of the sex mortality differential among blacks may be the result of lower smoking rates, fewer accidental and violent deaths, more rapid economic advancement, and greater access to health care among African American women than men (Elo 2001).

Whereas sex differences in life expectancy widened over the course of the 20th century, racial differences in longevity decreased. At the beginning of the century, white females could expect to live 15.2 years longer than black females, and white males could expect to live 14.1 years longer than black males (Table 3.1). Between 1900 and 1960, the white-black difference in life expectancy dropped by 7 years for females (to 8.2 years) and 7.4 years for males (to 6.7 years). The reduction in the racial difference was due to more rapid increases in life expectancy among blacks. Black females continued to make substantial progress after 1960, with a 3-year reduction in the racial gap in life expectancy by 1998 (to 5.2 years). On the other hand, progress was reversed among black males; their disadvantage relative to white males increased by 0.2 years between 1960 and 1998. Despite the tremendous gains in longevity among blacks, racial parity in life expectancy had yet to be achieved by the century's end.

The secular decline in mortality during the twentieth century reflects the aggregate effect of changes in mortality from specific causes. Table 3.2 presents age-adjusted death

rates by race and sex from 1960 to 1997 for eight leading causes of death: heart disease, cerebrovascular disease, all cancers, respiratory cancer, HIV infection, motor vehicle accidents, suicide, and homicide. Heart disease tops the list because of its importance in overall mortality as well as in its secular decline, accounting for 37.6 percent of the age-adjusted, all-cause death rate in 1960 and 27.2 percent in 1997 (NCHS 1999a). Cardiovascular diseases were responsible for 84 percent of the modest decline in overall mortality from 1954-67 and 64 percent of the decline from 1968-77 (Crimmins 1981). Age-adjusted death rates for heart disease posted double-digit percent declines for all race-sex groups during each decade, with the exception of white and black males from 1960 to 1970 (Table 3.2). Mortality from cerebrovascular disease, or stroke, also showed tremendous declines over the four-decade period, particularly between 1970 and 1990 when declines ranged from 28 to 43 percent. Though overall mortality declines were driven by lower death rates from diseases such as heart disease and stroke, the relative contributions to these declines made by the widespread use of effective anti-hypertensive drugs, improvements in lifestyle, and increased access to medical care are difficult to assess (Crimmins 1981; Preston 1993).

Cancer, the second leading cause of death for most groups, provides a stark contrast to heart disease and stroke. White females showed modest declines during the 1960-70 (-1.7 percent) and 1990-97 (-4.7 percent) periods and increases in the middle decades (+0.1 percent and +3.2 percent in 1970-80 and 1980-90, respectively). Black females exhibited a similar pattern of declines in the earliest and latest periods (-3.4 percent and -4.4 percent, respectively) and increases in the middle period (+5.0 percent and +5.8 percent in 1970-80

and 1980-90, respectively). Consistent with the increases in mortality between 1954 and 1968 among white and black men described above (Crimmins 1981; NCHS 1971), these two groups recorded substantial increases in cancer mortality between 1960 and 1970. Age-adjusted death rates for this cause increased over the decade by 9.0 percent for whites males and 24.9 percent for black males. An increase of 4.0 percent was also recorded for white males for 1970-80, but declines in the most recent periods (-0.1 percent in 1980-90 and -9.0 percent in 1990-97). Black males continued to post large increases in cancer mortality in the middle two decades (+16.1 percent and +7.9 percent in 1970-80 and 1980-90, respectively), but showed an impressive decline of 13.4 percent in the most recent period. Respiratory cancer, the leading cause of cancer incidence and death (Garfinkel and Silverberg 1990), is linked to prolonged exposure to tobacco smoke (Doll and Peto 1978; Klebba 1982). At best, trends for this cause among women have shown a slowing of the rate of *increase* in mortality: between 1960 and 1997, decade-to-decade increases in age-adjusted death rates declined from 98.0 percent to 5.7 percent for white females and from 98.2 to 2.9 percent for black females. Rates of increase also diminished over the first three decades for males, but this group recorded substantial decreases in death rates over the most recent period (-12.9 percent for white males and -17.1 percent for black males).

Human immunodeficiency virus (HIV) infection, the only infectious disease listed in Table 3.2, did not emerge as a cause of death until after 1981. However, the disease spread at an alarming rate and, with no known cure, quickly became a leading cause of death. By 1988, HIV infection/AIDS had become the third leading cause of death among men and the eighth leading cause of death among women 25-44 years of age (Centers for Disease

Control and Prevention [CDC] 1991). Mortality from HIV infection also contributed to the *decrease* in life expectancy recorded for blacks between 1984 and 1989 (Kochanek, Maurer, and Rosenberg 1994). As Table 3.2 clearly shows, mortality from this cause of death varies tremendously by race and sex. The age-adjusted death rate for white females was only 1.1 HIV-related deaths per 100,000 population in 1990 and slightly lower in 1997. Although white males recorded a 62.7 percent decline in HIV-related mortality over the period 1990-97, age-adjusted death rates in this group exceeded those for white females by 5 to 14 deaths per 100,000. An settling trend is evident for black females, with a 34.3 percent increase in mortality between 1990 and 1997, from 9.9 to 13.3 deaths per 100,000. Black males have by far the highest death rates from HIV infection, though there was a decline from 44.2 to 38.5 deaths per 100,000 over the most recent seven-year period.

The last three causes of death shown in Table 3.2 are external causes. Mortality from these causes of death are most heavily concentrated in young and middle adulthood, with clear differences between race and sex groups. The most striking difference is the excess mortality among males from motor vehicle accidents, suicide, and homicide, which is attributed to a higher prevalence of risk-taking behavior among males (Waldron 1976). Relative to white males, black males are more likely to die from motor vehicle accidents and homicide, but are less likely to die from suicide. Males in both race groups recorded increases in mortality from all three causes between 1960 and 1970; declines in mortality from motor vehicle accidents and homicide and increases in mortality from suicide in the middle two decades (except that homicide death rates increased for white males from 1970 to 1980); and substantial declines in mortality from all three causes in the most recent period

(1990-97). There were also substantial increases in death rates from all three causes for white and black females between 1960 and 1970. White females recorded declines in death rates from all three causes in the three most recent periods (except for an increase in homicide during 1970-80). Black females have shown consistent declines in mortality from homicide and either declines or stability in mortality from suicide since 1970. Despite large declines in mortality from motor vehicle accidents between 1970 and 1980, black females recorded the only increases in age-adjusted death rates from this cause between 1980 and 1997.

The net effect of mortality change since 1960 from leading causes of death, as well as from hundreds of other causes, has been in the downward direction. Lower overall death rates increase the probability of survival to higher ages, which adds additional years to life expectancy and contributes to positive population growth. Although probabilities of survival to ages of reproduction were already very high by 1960, as Hermalin (1966) points out, further declines in mortality at young ages have allowed more children to be born and survive, thus adding further to population growth. The objective of this study, then, is to assess the relative effects of mortality change on population growth across a wider range of causes of death and race-sex categories than has heretofore been undertaken. Before describing how causes of death were selected for this study, an area of health and mortality research that informed this process will be reviewed.

AVOIDABLE MORTALITY

Since the late 1960s, medicine and health care have played increasingly important

roles in mortality decline. Advancements in the treatment of leading causes of death, particularly cardiovascular diseases, and increased access to medical care through Medicare and Medicaid have contributed to the rapid fall in death rates that occurred during the 1970s and 1980s (McKinlay, McKinlay, and Beaglehold 1989; Preston 1993). However, quantifying the degree to which medical progress and expanded access to health care contribute to observed mortality declines is not a simple task (Crimmins 1981). Over two decades ago the Preventable and Manageable Diseases Working Group developed a method for measuring the quality of medical care which involves enumerating cases of "unnecessary disease and disability, and unnecessary untimely deaths" (Rutstein et al. 1976). The Working Group defined *medical care* in broad terms to include the application of relevant medical knowledge and research, health care services, available resources, and cooperative responsibility of the patient. A *sentinel health event* was defined as a case of illness, disability, or death which could have been prevented given reasonable access to the health care system and the existing capabilities of medicine. That is, sentinel health events are considered to be *medically avoidable*.

The original list of conditions considered amenable to prevention or treatment has been updated over time and used to examine trends in cause-specific mortality as a means of measuring the quality of medical services at the population level (see, for example, Charlton, Hartley, Silver, and Holland 1983; Charlton and Velez 1986; Holland 1991, 1993; Mackenbach et al. 1988a, 1988b; Pampalon 1993; Poikolainen and Eskola 1988). Studies such as these, not Rutstein and colleagues (1976), adopted the term *avoidable mortality*. Of course, avoidable mortality is not meant to imply *im*mortality. Everyone must die eventually,

and, even with access to state-of-the-art medical care, not all deaths from these causes can be prevented, avoided, or delayed. Rather, the concept of avoidable mortality refers to conditions for which effective preventive or therapeutic measures *do* exist and which *could* reasonably delay death to a more advanced age.

Avoidable causes of death have been partitioned into two groups: *primary prevention* or *health policy* indicators, such as lung cancer, cirrhosis of the liver, and motor vehicle accidents; and *secondary prevention* or *medical care* indicators, which include conditions with clearly identifiable interventions and health care providers (Holland 1991). In an approach similar to the health policy categorization, Rogers, Hummer, Nam, and Peters (1996) group together causes considered to be *social pathologies*, which includes suicide, accidents, homicide, and cirrhosis. Mortality from causes in the health policy category is influenced primarily by the prevalence behavioral risk factors and the effectiveness of public health programs, thus such deaths may be considered *behaviorally avoidable*. Mortality from causes in the medical care category, on the other hand, is influenced primarily by access to and quality and utilization of health services, thus such deaths may be considered *medically avoidable*. The distinction between behaviorally and medically avoidable causes is often arbitrary since mortality from many causes (e.g., cardiovascular disease) can be amenable to both behavioral and medical interventions.

Cross-national comparisons of trends in mortality from avoidable and non-avoidable causes find that mortality has declined since 1950 much more rapidly from avoidable causes than from other causes of death in Europe, North America, and Japan (Charlton and Velez 1986; Boys, Forster, and Józan 1991). Other studies find that death rates from avoidable

causes are higher among members of lower socioeconomic strata (Wood, Sallar, Schechter, and Hogg 1999), that social inequalities are greater for avoidable than non-avoidable causes (Marshall, Kawachi, Pearce, and Borman 1993), and that avoidable mortality has declined more rapidly for higher socioeconomic groups (Mackenbach, Stronks, and Kunst 1989). In contrast, a study using Swedish data finds few significant differences in mortality from avoidable causes between blue-collar, white-collar, and self-employed workers (Westerling, Gullberg, and Rosén 1996). In an analysis of 1978 mortality data from Alameda County, California, Woolhandler and colleagues (1985) find that over one-third of the excess in the all-cause death rate for blacks relative to whites was attributable to higher mortality from avoidable causes of death. Rogers, Hummer, Nam, and Peters (1996) find that mortality from social pathologies (suicide, accidents, homicide, and cirrhosis combined) is highest among Native Americans, followed by African Americans, Mexican Americans, and Caucasian Americans.

Given that Medicare and Medicaid reduced racial disparities in access to medical care (Long and Settle 1984; Gornick et al. 1996), racial differences in mortality from medically avoidable causes may have contracted more rapidly than differences in mortality from other causes. However, as Preston (1996) suggests, recent decades have been a period of widening social class differences in mortality. Growing inequities in education and income, which tend to favor whites over blacks, may exacerbate differences in mortality from causes of death that are amenable to medical care. Furthermore, differences between males and females, although apparently contracting in terms of life expectancy among whites, may have also worsened over time for certain causes of death. Between 1960 and 1989, educational

differences in mortality increased markedly for men (Feldman, Makuc, Kleinman, and Cornoni-Huntley 1989; Pappas, Queen, Hadden, and Fisher 1993; Preston and Elo 1995), but not for women. Though this study does not examine trends in mortality by education or any other socioeconomic indicator, increasing social inequalities will ultimately affect mortality differences by race and sex, especially for medically or behaviorally avoidable causes of death.

A comprehensive list of avoidable causes of death was compiled from a review of studies between 1976 and 2000. Not all studies of avoidable mortality reviewed contributed to the list used here because many studies adopted the same set of causes employed by previous authors. The list of avoidable causes used for this study is drawn from the following studies: Charlton, Hartley, Silver, and Holland (1983); Charlton and Velez 1986; Holland (1991, 1993); Mackenbach et al. (1988a, 1988b); Poikolainen and Eskola (1986, 1988); Rutstein et al. (1976); and Simonato, Ballard, Bellini, and Winkelman (1998).

CLASSIFICATION OF CAUSES OF DEATH

The standard system used to classify causes of death is the International Statistical Classification of Diseases, Injuries, and Causes of Death (ICD) compiled by the World Health Organization. Much of the ICD's modern structure is due to William Farr (1807-1883), a medical statistician with the General Register Office of England and Wales during the nineteenth century. The first international classification of causes of death, developed by Jacques Bertillon (1851-1922) and adopted by the International Statistical Institute in 1893, was based on Farr's principle "of distinguishing between general diseases and those

localized to a particular organ or anatomical site" (World Health Organization 1977:x). The first International Conference for the revision of the Bertillon or International Classification of Causes of Death was held in 1900. The ICD has since been revised on an approximately decennial basis to incorporate changes in existing medical knowledge, adopt contemporary nomenclature, and update guidelines for cause-of-death coding. Deaths in the United States are usually coded according to the most recent revision of the ICD. For the study period covered in this chapter, this includes the Seventh (deaths from 1960-67), the Eighth (1968-78), and Ninth (1979-96) Revisions.[1]

For this study, an exhaustive, mutually exclusive list of 28 cause-of-death groups was developed, which is shown, along with corresponding ICD numbers for each Revision, in Table A3.1 in the Appendix. In developing the list of causes, a concerted effort was made to maintain comparability across the three revisions of the ICD. This was done by: 1) limiting causes of death to those which are clearly identifiable in each of revision of the ICD; and 2) grouping many specific causes of death into larger categories to minimize the impact of coding and classification changes between revisions. However, despite these efforts, discontinuities between revisions remain in the death series for certain causes, thus limiting the ability to precisely estimate the demographic impact of mortality change over time.

Comparability ratios published by the National Center for Health Statistics (1975a, 1980) estimate the magnitude of discontinuities between the Seventh and Eighth and between

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1 Although the tenth revision of the ICD was introduced in 1989 (World Health Organization 1992), it has only recently been adopted in the United States.

the Eighth and Ninth Revisions for selected causes of death.[2] Ostensibly, comparability ratios can be used to adjust cause-specific death counts to make death series more consistent over time (i.e., across ICD revisions). For example, the comparability ratio for ischemic heart disease between the Seventh and Eighth Revisions is 1.1457 (see Table A3.1), which suggests that, for a deaths in a given year, 15 percent more would be assigned to this cause using the coding and classification rules of the Eighth Revision rather than those of the Seventh Revision. Thus, when the Eighth Revision was implemented in 1968 there was a sharp increase in death rates for ischemic heart disease between 1967 and 1968 that was an artifact of coding and classification changes. The comparability ratio for ischemic heart disease between the Eighth and Ninth Revisions of the ICD is 0.8784 (NCHS 1980), indicating that fewer deaths were assigned to this cause after the Ninth Revision was introduced in 1979.

Comparability ratios between the three ICD revisions are included in Table A3.1 for most cause groups. Although the ratios suggest that mortality trends over time are not strictly comparable for certain causes, they are not used to adjust the mortality data in this study for the following reasons: comparability ratios are not available for all causes under investigation; comparability ratios are derived from dual coding of deaths from a single year

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2 Comparability ratios in the earlier report (NCHS 1975a) are based on coding the same deaths in 1966 according to both the Seventh and Eighth Revisions. For a given cause of death, the comparability ratio is computed by dividing the number of deaths in 1966 assigned to that cause using the Eighth Revision rules by the number of deaths in 1966 assigned to that cause using the Seventh Revision. Ratios of 1.00 indicate the same number of deaths was assigned to a particular cause whether the Seventh or Eighth Revision was used. Ratios greater than 1.00 indicate that more deaths were assigned to the cause using the Eighth Revision, while ratios below 1.00 indicate that fewer deaths were assigned to the cause using the Eighth Revision. This dual coding method was applied to deaths in 1976 to obtain comparability ratios between the Eighth and Ninth Revisions (NCHS 1980).

preceding a new revision, thus the validity of the ratios over time is questionable; inflating/deflating death counts for particular cause groups would require offsetting adjustments in all other cause groups; and adjusting death counts across two revisions of the ICD may introduce more measurement error than it would alleviate. Thus, the results for some cause groups may be sensitive to classification and coding changes between revisions of the ICD. The only results unaffected by changes in the ICD are those based on mortality data between 1979 and 1996, which were coded according to the Ninth Revision.

The rationale behind the selection of each cause group is summarized below. Cause groups considered to be medically avoidable (amenable to preventive and therapeutic health interventions) or behaviorally avoidable (amenable to alterations in behavior and lifestyle factors) are identified.

1. Tuberculosis, all forms

As shown in White's (1999) analysis, declines in tuberculosis mortality since 1900 have had a substantial impact on the size of the current U.S. population. Although mortality from this cause had already fallen from around 190 deaths per 100,000 in 1900 to less than 10 deaths per 100,000 by 1960 (Grove and Hetzel 1968), tuberculosis was still the eighth leading cause of death among nonwhite males in 1960 (NCHS 1963). Tuberculosis is considered medically avoidable.

2. HIV infection

As mentioned above, HIV infection arose during the 1980s as a major public health threat that, within a remarkably short period of time, became a leading causes of death for certain age, race, and sex groups. For 1984-86 most HIV-related deaths were assigned to the

category of 'deficiency of cell-mediated immunity' (ICD No. 279.1; NCHS 1989), and this code is used to identify deaths from HIV infection for these years. For more recent years, HIV-related deaths are identified using special codes (ICD Nos. *042-*044) introduced by the National Center for Health Statistics in 1987 (NCHS 1989). HIV infection is behaviorally avoidable.

3. Other infectious and parasitic diseases

This category includes all infectious and parasitic diseases other than tuberculosis and HIV infection, such as: bacterial and viral infectious diseases; arthropod-borne diseases; syphilis and other venereal diseases; spirochaetal diseases; mycoses; helminthiaseses; and other infectious and parasitic diseases and late effects. All of these diseases are considered medically avoidable.

4. Cancer, buccal cavity, pharynx, esophagus, and larynx

Cancers of the buccal (oral) cavity, pharynx, esophagus, and larynx are causally related to smoking (Klebba 1982), with at least 70 percent of deaths from these causes attributable to smoking and other tobacco use (CDC 1993b). Most deaths from these forms of cancer are considered behaviorally avoidable.

5. Cancer, trachea, bronchus, and lung

Cancer of the trachea, bronchus, and lung (respiratory system), as described above, is also linked to smoking (Doll and Peto 1978; Klebba 1982). Along with the previous group of smoking-related causes, trends for this cause of death will be used to approximate the demographic impact of mortality from smoking. Most lung cancer deaths are behaviorally avoidable.

6. Cancer, other avoidable forms

This cause group includes forms of cancer which are avoidable through either preventive measures (e.g., skin cancer and cervical cancer) and medical intervention (e.g., Hodgkin's disease and leukemia). This group also includes cancers of the following sites: colon and rectum, liver, breast, vagina, testis, kidney, bladder, eye, and thyroid.

7. Cancer, all other forms

This residual category includes cancers of sites not listed above, as well as benign neoplasms, carcinoma in situ, and unspecified neoplasms.

8. Diabetes mellitus

Diabetes mellitus, a disease of the endocrine system, was the eighth leading cause of death among white females and the seventh leading cause of death among nonwhite females in 1960 (NCHS 1963). In 1992, diabetes was one of the ten leading causes of death among whites and blacks of both sexes, ranking as high as number four among black females (Gardner, Rosenberg, and Wilson 1996). Diabetes mellitus is considered medically avoidable.

9. Other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, and sense organ diseases

The Ninth Revision of the ICD organizes these diseases into three separate chapters–III. endocrine, nutritional, and metabolic diseases, and immunity disorders; IV. diseases of the blood and blood-forming organs; and VI. diseases of the nervous system and sense organs. All of these conditions are grouped together not because of their etiological similarity or anatomical proximity but for convenience, as deaths from most of these causes

are quite rare. In this particular group, only avoidable causes are included: diseases of the thyroid; nutritional deficiencies; anemias; hemophilia; bacterial meningitis; epilepsy; cataract; glaucoma; and otitis media and mastoiditis.

10. Other endocrine, metabolic, immunity, nutritional, blood, nervous system, and sense organ diseases

Includes all causes of death in these categories not enumerated in the previous cause group, such as: diseases of the endocrine glands (other than diabetes mellitus); various metabolic and immunity disorders; certain coagulation defects, haemorrhagic conditions, and other diseases of the blood and blood-forming organs; inflammatory, hereditary and degenerative, and other types of diseases of the central nervous system (other than meningitis and epilepsy); disorders of the peripheral nervous system; and non-avoidable disorders/diseases of the eye and adnexa and of the ear and mastoid process.

11. Cerebrovascular disease

Mortality from cerebrovascular disease, or stroke, has declined tremendously in all race-sex groups since 1960, as shown in Table 3.2. Much of this decline is credited to the introduction and proliferation of effective anti-hypertensive drugs in the late 1960s (Preston 1993). Given the increasing efficacy of therapeutic interventions over the past few decades, many studies consider mortality from this condition to be medically avoidable. As with certain forms of cancer and most circulatory diseases that follow, healthy lifestyle and behaviors are also protective against the development of cerebrovascular disease, thus blurring the distinction between medically and behaviorally avoidable causes of death.

12. Rheumatic fever and chronic rheumatic heart disease

Rheumatic fever occurs primarily in children following a group A streptococcal upper respiratory infection. Repeated exposure to rheumatic fever can damage heart valves and lead to the development of chronic rheumatic heart disease in adulthood (Elo and Preston 1992). Given its infectious origins, this cause is considered medically avoidable.

13. Ischemic heart disease

Ischemic heart disease accounts for more deaths than any other single condition. Deaths from ischemic heart disease accounted for 25.5 percent of the age-adjusted death rate for all causes combined in 1980, a share which declined to 19.7 percent in 1990 and 17.3 percent in 1997 (NCHS 1999a).

14. Hypertensive disease

As with cerebrovascular disease, mortality from this condition declined precipitously following the widespread use of drugs that effectively lower blood pressure. This cause is considered medically avoidable.

15. Atherosclerosis

This condition has consistently been a leading cause of death since 1960 (NCHS 1963, 1974, 1994; CDC 1997b).

16. Other circulatory diseases

Includes remaining diseases of the circulatory system not listed above: other forms of heart disease; diseases of arteries, arterioles, and capillaries (other than atherosclerosis); and diseases of veins and lymphatics, and other diseases of the circulatory system.

17. Pneumonia & influenza

Pneumonia and influenza comprised the fifth or sixth leading cause of death among whites and nonwhites of both sexes in 1960 (NCHS 1963), and this ranking has been maintained consistently through 1996 (NCHS 1963, 1974, 1994; CDC 1997b). Deaths from these two conditions are considered medically avoidable.

18. Other respiratory diseases

This category includes all respiratory diseases other than pneumonia and influenza. These diseases are considered to be medically avoidable, though over half of all deaths from chronic obstructive pulmonary diseases (e.g., chronic bronchitis and emphysema) are associated with smoking (CDC 1997a).

19. Chronic liver disease & cirrhosis

Most adult deaths from this cause are associated with excessive use of alcohol (CDC 1990), and thus are considered behaviorally avoidable.

20. Other avoidable digestive & genitourinary diseases

Since deaths from many digestive and genitourinary diseases are uncommon, mortality for these types of conditions are grouped together. This cause group includes those considered to be medically avoidable: diseases of the teeth and supporting structures; ulcers; gastrititis and duodenitits; appendicitis; hernia; intestinal obstruction; cholelithiasis and cholecystitis; nephritis and nephrosis; kidney infections; calculus of urinary system; stricture of urethra; hyperplasia of prostate; and diseases of breast, uterus, and other female genital organs.

21. Other digestive and genitourinary diseases

Includes all digestive and genitourinary diseases not listed above.

22. Certain causes of perinatal mortality

These conditions, which include damage to a fetus or newborn during pregnancy or labor as well as other complications of infant development, have declined in ranking over time as leading causes of death. In 1960, diseases of early infancy (as this group of conditions was formally called) ranked sixth or higher among whites and nonwhites of both sexes (NCHS 1963). Perinatal causes had a similar overall ranking in 1970, but had declined to the fifteen leading cause of death in the total population by 1990 (NCHS 1974, 1994). However, the decline in ranking was not consistent by race. Whereas these conditions had declined in importance among whites, in 1992 perinatal conditions were still ranked as high as the seventh and ninth leading causes of death among black females and males, respectively (Gardner, Rosenberg and Wilson 1996).

23. Other avoidable conditions

This residual category includes other avoidable, non-external causes of death not listed above: complications of pregnancy, childbirth, and the puerperium; diseases of the skin and subcutaneous tissues; arthritis and spondylitis; non-articular and unspecified rheumatism; osteomyelitis and periostitis; ankylosis and acquired musculoskeletal deformities; and congenital anomalies of the circulatory and digestive systems.

24. Motor vehicle accidents

As seen in Table 3.2, death rates from this external cause vary markedly by race and sex. This cause of death is considered behaviorally avoidable.

25. Suicide

This external cause of death has increased in importance over time. In 1960, suicide was one of the ten leading causes of death only among white males (ranked eighth; NCHS 1963). For the total population, suicide ranked eleventh in 1970 and eighth in 1990 (NCHS 1974, 1994). In 1992, suicide was the seventh leading cause of death among white males, but again it was not ranked among the ten leading causes of death for white females or blacks (Gardner, Rosenberg and Wilson 1996). Suicide is behaviorally avoidable.

26. Homicide and legal intervention

Trends in mortality from homicide and legal intervention have also differed greatly by race and sex (Table 3.2). Homicide was the seventh leading cause of death among nonwhite males in 1960, but was not among the ten leading causes of death for nonwhite females or whites (NCHS 1963). For the total population, homicide was the twelfth leading cause of death in 1970 and the eleventh leading cause of death in 1990 (NCHS 1974, 1994). But this violent cause continued to have a greater impact on the black population, ranking as the third and tenth leading causes of death in 1992 among black males and females, respectively (Gardner, Rosenberg and Wilson 1996). Homicide and legal intervention is a behaviorally avoidable cause of death.

27. Other accidents and injuries

This category includes all external causes other than motor vehicle accidents, suicide, and homicide, such as: rail, water, and air transport accidents; accidental poisoning; accidental falls; injuries from fire and environmental factors; surgical and medical complications and misadventures; injury resulting from operations of war; and late effects

of accidental injury. These causes are behaviorally avoidable.

28. All other causes

This residual category includes all remaining causes: mental disorders; non-avoidable diseases of the musculoskeletal system and connective tissue; non-avoidable congenital anomalies; and symptoms and ill-defined conditions.

Broad cause groups

Some of the 28 cause groups are combined into larger categories to assess the demographic consequences of mortality change for a wider range of related conditions. The following seven broad cause groups were also examined: All causes combined; all infectious and parasitic diseases (cause groups 1-3); all cancers (cause groups 4-7); all circulatory diseases (cause groups 11-16); all external causes (cause groups 24-27); smoking and alcohol-related diseases (includes cancer–buccal cavity, pharynx, esophagus, and larynx [4], cancer–trachea, bronchus, and lung [5], and chronic liver disease and cirrhosis [19]); and all medically avoidable conditions (cause groups 1, 3, 6, 8, 9, 11, 12, 14, 17, 18, 20, 22, and 23).

DATA AND METHODS

Population

Population data for whites aged 0-74 in 1960 and 0-85+ in 1970, 1980, and 1990 are from the Census Bureau's corrected population estimates derived by demographic analysis (U.S. Bureau of the Census 1985, 1992). Published Census estimates are used for whites aged 75+ in 1960 (U.S. Bureau of the Census 1974). Population estimates for blacks aged 0-84 in each census year from 1960 to 1990 are from a reconstruction of the African

American population that includes adjustments for census undercount and age misreporting on death certificates (Preston, Elo, Foster, and Fu 1998). Population estimates for blacks aged 85+ in 1960 are from Census publications (U.S. Bureau of the Census 1974) and in 1970, 1980, and 1990 are from demographic analysis estimates (U.S. Bureau of the Census 1985, 1992). Since five-year projection intervals are used, mid-decade population estimates are obtained by projecting the census-year population forward by five years using observed mortality, fertility, and net migration rates. All population estimates refer to April 1 of each year.

Mortality

Mortality data for 1960-67 are from the Centers for Disease Control and Prevention[3]; data for 1968-96 are from the publicly available Mortality Detail Files (1968-91) and Multiple Cause of Death Files (1992-96) produced by the National Center for Health Statistics.[4] Because of age misreporting, the quality of data on age distributions of deaths and population are particularly poor for blacks at older ages (Elo and Preston 1994), which can lead to substantial underestimates of death rates (Preston, Elo, Rosenwaike, and Hill 1996). The quality of age reporting for whites has been shown to be quite good up to about age 95 in recent decades (Preston, Hill, and Rosenwaike 2000). Generalized methods of adjusting mortality data for age misreporting have not been developed, thus the results for

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3 Matthew McKenna generously provided these data upon request.

4 Two adjustments were made to the mortality data. First, because New Jersey did not report deaths by race in 1962 and 1963, the average racial distribution of New Jersey deaths in 1961 and 1964 by age, sex, and cause was used to allocate deaths to race groups. Second, the National Center for Health Statistics coded only 50 percent of death certificates in 1972; death counts for this year were doubled.

blacks at older ages may be less reliable than those for whites.

Fertility

Fertility rates for blacks from 1960 to 1990 are revised estimates produced by the African American Mortality (AAM) Project (Elo 1996). Fertility rates for whites from 1960 to 1998 and for blacks from 1990 to 1998 are taken from vital statistics publications (Martin, Smith, Mathews, and Ventura 1999; NCHS 1999b; Ventura, Martin, Curtin, and Mathews 1998). Since fertility rates are not yet available for 1999 and 2000, rates observed in 1998 are assumed to prevail during these years. Age-race-specific fertility rates are available by age of the mother for each calendar year, from 10-14 to 45-49 years of age.[5]

Net Migration

Migration estimates used in this study are abstracted from unpublished Census Bureau demographic analysis estimates of intercensal population change between 1960 and 1990 (U.S. Bureau of the Census 1985, 1992). Estimates of net intercensal migration are unavailable for 1990-2000, so estimates for 1980-90 are assumed to prevail during this period. The sources of migration the Census Bureau considers are: legal alien immigration, refugees and parolees, net civilian citizenship, net Puerto Rican migration, net illegal/undocumented aliens, legal emigration, net resident status of foreign students, and net movements of armed forces overseas. For blacks, revised estimates of net Puerto Rican

5 Fertility rates in the highest age group for 1997 and 1998 relate births for mothers aged 45-54 to women aged 45-49 since most of the births in this age interval occur between ages 45 and 49.

migration produced by the AAM Project are used in place of Census Bureau estimates (Elo 1996). The Census Bureau's demographic analysis estimates, which track the trajectory of each five-year age cohort over the entire ten-year intercensal period, were allocated to five-year age groups in each five-year projection interval using a lexis diagram. Demographic analysis tables of intercensal migration identify the age group at the end of the intercensal period, so net migration was allocated to appropriate lexis triangles by following each five-year age group's cohort trajectory backwards in time.

Adjusting Mortality and Fertility to Census Years

To be consistent with census-year population estimates, deaths and fertility rates are adjusted to census years (April 1 to March 31). Vital statistics are tabulated by calendar years, so mortality data for 1960, for example, include deaths from January 1 - December 31, 1960. Following the procedure used by Preston and colleagues (1998), calendar-year data on deaths are separated into single-year periods defined at the April 1 census dates. This adjustment requires the assumption that deaths within a one-year block of age for a particular calendar year are evenly distributed by time of occurrence and age of the decedent. Under this assumption, deaths between ages x and $x+n$ in census year t_{cen} (for example, April 1, 1960 - April 1, 1961) are comprised of deaths during the last nine months of calendar year t_{cal} (April 1 - December 31, 1960), plus deaths during the first three months of calendar year $t_{cal}+1$ (January 1 - March 31, 1961). This assumption divides the year into quarters, so deaths in census year t_{cen} are calculated with the following formula:

$$ {}_nD_x(t_{cen}) = .75[\ {}_nD_x(t_{cal})] + .25[\ {}_nD_x(t_{cal}+1)] \quad (3.1) $$

The assumption of deaths evenly distributed over time is necessary only for deaths occurring between 1960 and 1967; information on month of death is available for deaths occurring between 1968 and 1996.

Fertility rates are adjusted to census years by assuming no seasonal variation in births (fertility rates for black women produced by the AAM Project are already adjusted to census years). Similar to the assumption of deaths being evenly distributed over age and time for 1960-67, births are calculated using a formula similar to equation 3.1, replacing deaths between ages x and $x+n$ (${}_nD_x$) with fertility rates between ages x and $x+n$ (${}_nF_x$). To obtain fertility rates for five-year periods, census-year fertility rates are averaged over five years. For example, in the projection from 1960 to 1965, the female population in 1960 is subjected to the average of age-race-specific census-year fertility rates for 1960, 1961, 1962, 1963, 1964, and 1965.

Multiple-Decrement Life Table Procedures

The primary analytic procedure for this study is a series of projections of the U.S. population from 1960 to 2000 while holding mortality from each cause of death constant during various time periods. This involves surviving the population forward in five-year intervals of age and time using life table survival ratios calculated for the period at the beginning of each projection interval. Multiple-decrement life tables are constructed to

obtain the survival ratios used in the projections. Following the basic procedures outlined in Preston, Heuveline, and Guillot (2000: Ch. 4), multiple-decrement life tables by sex and race are constructed as follows.

Following the convention used to construct U.S. Decennial Life Tables (NCHS 1967, 1975b, 1997a), central death rates for ages x to $x+n$, ${}_nM_x\,(t\text{-}1,t\text{+}1)$, are calculated by relating deaths between ages x and $x+n$ during the three-year period centered at the beginning each five-year projection interval, ${}_nD_x\,(t\text{-}1,t\text{+}1)$, to the population between ages x and $x+n$ in the middle of the period, ${}_nN_x(t)$:

$$ {}_nM_x\,(t-1,t+1) = \frac{{}_nD_x\,(t-1,t+1)}{3 \cdot {}_nN_x\,(t)} \qquad (3.2) $$

Thus, the multiple-decrement life table used to survive the U.S. population forward for five years from 1960 to 1965, for example, is based on death rates averaged over 1959-61. Death rates are calculated for five-year age groups up to age 84 and an open-ended category for ages 85 and above.

To construct a multiple-decrement life table, a conventional life table for mortality from all causes combined is constructed by assuming that ${}_nM_x = {}_nm_x$ (i.e., the set of period age-race-sex-specific death rates observed in the population is assumed to prevail in the life table), using a radix of 100,000, and borrowing sex-specific ${}_na_x$ (the average number of person-years lived by those dying between ages x and $x+n$) values estimated for the U.S. at

various time periods (Keyfitz and Flieger 1968, 1990).[6] With causes of death grouped into 28 exhaustive, mutually exclusive categories, the following relationship holds:

$$ {}_nm_x = \sum_i {}_nm_x^i \qquad (3.3) $$

where i indexes the cause groups. Cause-specific probabilities of dying between ages x and $x+n$, ${}_nq_x^i$, are constructed using the following formula:

$$ {}_nq_x^i = {}_nq_x \cdot \frac{{}_nm_x^i}{{}_nm_x} \qquad (3.4) $$

Though the completion of a multiple-decrement life table normally involves computing the number of decrements from cause i between ages x and $x+n$ (${}_nd_x^i = {}_nq_x^i \cdot l_x$) and the number of persons aged x who will eventually leave the table from cause i ($l_x^i = \sum_x {}_nd_x^i$), these columns are not necessary for the counterfactual projections. Life table survival ratios (${}_5L_x/{}_5L_{x-5}$) are used to survive the population forward over the five-year projection interval, and these ratios depend only on the l_x, ${}_nd_x$, and ${}_na_x$ columns since ${}_nL_x$ values are calculated as ${}_nL_x = n \cdot l_{x+n} + {}_na_x \cdot {}_nd_x$. Values of ${}_nL_x$ depend on the underlying death rate between ages x and $x+n$, ${}_nm_x$, which represents the sum of all death rates over cause i between ages x and $x+n$ (equation 3.3). Thus, the life table survival ratios based on a multiple-decrement life table with mortality held constant for a particular cause reflect this counterfactual assumption. For

6 Keyfitz and Flieger use the conventional grouping of ages 0-4 into 0 and 1-4 years of age, so ${}_5a_1$ is calculated as $0.2({}_1a_0) + 0.8({}_4a_1)$. Also, the most recent year for which ${}_na_x$ values are available is 1985; values for this year are used in the life tables for 1989-91 and 1994-96.

example, if death rates from tuberculosis have declined since 1960, then survival ratios will be higher (i.e., the risk of death will be lower) when death rates from this cause are held constant than the survival ratios based on observed mortality.

Population Projection Methods

This study employs the cohort component projection method, the standard demographic procedure used for population projections. As described in Preston, Heuveline, and Guillot (2000:Chapter 6), the cohort component method consists of three steps repeated for each projection interval: 1) survive the population forward by age, race, and sex at the beginning of the projection interval to estimate the number alive at the beginning of the next interval; 2) compute the number of births to each age-race-sex group over the projection interval and survive them forward; and 3) adjust for net migration, add migrants' births, and survive migrants and their children forward. A female-dominant projection is employed, whereby the number of births is estimated by applying fertility rates only to women. Births are allocated by sex using the conventional sex ratio at birth of 1.05 males/female.

The cohort component projection method is used to survive the U.S. population forward, separately by race and sex, between 1960 and 2000 for the following fixed-mortality scenarios. For each of the 28 causes of death listed above, as well as each of the seven broader cause groups, each race-sex-specific population is projected to 2000 with mortality from the selected cause fixed at four different levels: 1960 (average mortality for 1959-61), 1970 (1969-71), 1980 (1979-81), and 1990 (1989-91). When death rates from each cause are fixed at a particular level, death rates from all other causes are allowed to change as

observed in the actual population. Furthermore, in all projections fertility and migration are allowed to change as observed in the population.

The benchmarks against which all fixed-mortality projections are compared are the race-sex-specific populations projected from 1960 to 2000 under observed mortality conditions, which are referred to as "actual" populations. The race-sex-specific actual populations closely resemble the resident population by race and sex estimated by the Census Bureau (U.S. Bureau of the Census 2000). In Table A3.2 in the Appendix, the two sets of population estimates are compared using the ratio of the actual projected population to the census population at each age and for the total population. One key source of difference between the projected populations and the Census Bureau estimates is that the projections are based on populations adjusted for undercount whereas the Census Bureau's estimates are not adjusted. The actual population is 0.8 percent larger than the census population for white males and females, whereas the actual population is 0.4 percent smaller than the census population for black females. For black males, the actual population is 2.6 percent larger than the census population. Differences between the actual and census populations are more variable across age groups, with ratios as low as 0.911 (white males ages 85+) and as high as 1.114 (black males ages 50-54). The average ratio over all ages is 1.005 for white females, 1.000 for white males, 0.995 for black females, and 1.020 for black males.

RESULTS

Tables 3.3-3.6 present components of population change by decade from 1960 to 2000 for each projection, separately by race and sex. The first and second columns in each

table identify the fixed-mortality scenario and decade for each projection, respectively. Column 3 displays the cumulative population growth by decade for each mortality scenario. Column 4 shows the additional population realized under observed mortality conditions, derived by subtracting population growth under fixed-mortality conditions from population growth under observed conditions. Negative values in column 4 indicate that more population was added over time with cause-specific mortality fixed at a given level; in other words, mortality conditions were more favorable in the fixed-mortality scenario. Column 5 shows additional population under observed conditions as a percentage of the actual population at the end of each decade. This column indicates the share of the actual population that is alive as a result of mortality declines and can be used to compare the relative impact of mortality change by cause and decade. If additional population growth (column 4) is negative, then column 5 denotes losses from mortality increase as a percentage of the actual population. Cumulative population growth is the net result of losses from deaths from all causes combined (column 6), additions from births (column 9), and net migration (not shown).[7] Deaths prevented under observed conditions (column 7) are derived by subtracting cumulative observed-mortality deaths from cumulative fixed-mortality deaths. Negative values in this column indicate more deaths (higher mortality) under observed conditions. Column 8 shows cumulative prevented deaths as a percentage of the actual

7 Deaths are derived using the balancing equation of population change (Preston, Heuveline, and Guillot 2000). The number of persons alive in a population in year t, N(t), is determined by the following identity: $N(t) = N(0) + B[0,t] - D[0,t] + NM[0,t]$, where N(0) is the number of persons alive in the population in year 0; B[0,t] is the number of births in the population between year 0 and year t; D[0,t] is the number of deaths in the population between year 0 and year t; and NM[0,t] is net migration into the population between year 0 and year t. Since N(0), N(t), B[0,t], and NM[0,t] are known, D[0,t] is obtained by rearranging the equation as follows: $D[0,t] = N(0) - N(t) + B[0,t] + NM[0,t]$.

population at the end of each decade. Additional births under observed conditions (column 10) is derived by subtracting cumulative fixed-mortality births from cumulative observed-mortality births. Negative values in this column indicate fewer births under observed conditions. Cumulative additional births are also shown as a percentage of the actual population at the end of each decade (column 11). Since net migration is the same under observed and fixed-mortality conditions, cumulative additional population under observed mortality conditions is comprised of the sum of cumulative deaths prevented and cumulative additional births (slight errors of closure are due to rounding).

The discussion of results follows the order of causes as shown in Tables 3.3-3.6. Results for all causes combined are followed by results for infectious and parasitic diseases, cancers, circulatory diseases, external causes, smoking and alcohol-related diseases, medically avoidable causes, and other causes. Results are shown for white females in Table 3.3, for white males in Table 3.4, for black females in Table 3.5, and for black males in Table 3.6.[8] Given the daunting amount of information presented in Tables 3.3-3.6, two summary tables have been constructed to facilitate comparisons across race-sex groups and time periods. Table 3.7 tabulates the cumulative proportionate impact of mortality change for the seven broad cause groups by time period, race, and sex. Table 3.8 tabulates similar figures for specific causes of death. The eight causes of death with the greatest proportionate impact across race and sex for various time periods are shown.

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8 Because the results in Tables 3.3-3.6 are approximations of the demographic impact of cause-specific mortality change over time, the discussion usually refers to figures rounded to the nearest thousand.

All Causes Combined

Differences between populations projected under observed and fixed-mortality from all causes combined reflect the net effect of mortality change from all specific causes. Because all-cause mortality declined steadily from 1960 to 2000, cumulative population growth was greater under observed mortality conditions than under fixed-mortality conditions. The only exception to this finding is for white females in the most recent decade with mortality fixed at 1990 levels (Table 3.3). Life tables used for these projections show that death rates among white females at ages 75 and above were higher in 1994-96 than in 1990, which may account for the additional deaths under observed mortality conditions.

Cumulative population growth resulting from overall mortality decline since 1960 totals 4.01 million for white females (Table 3.3), 4.27 million for white males (Table 3.4), 0.92 million for black females (Table 3.5), and 0.51 million for black males (Table 3.6). Cumulative population growth over time is shown graphically for each race-sex group in Figure 3.1. The proportionate impact of overall mortality decline from 1960 levels has been greatest for black females: 5.04 percent of the actual population in 2000 is alive because of lower mortality. The second largest proportionate impact of mortality decline since 1960 has been for white males, accounting for 3.84 percent of the population alive in 2000. There was nearly as large an impact for white females, with 3.48 percent of the population alive because of mortality declines over the past forty years. Finally, 3.02 percent of black males alive in 2000 owe their existence or survival to mortality declines since 1960. The gain in population for white and black females combined since 1960–3.69 percent–is very close to the 4 percent gain Hermalin (1966) projected for the total female population. The overwhelming majority

of population growth has been the result of cumulative deaths prevented rather than additional births. Of the additions to population since 1960 attributable to mortality decline, the share from deaths prevented is 97.3 percent for white females, 97.4 percent for white males, 92.0 percent for black females, and 85.0 percent for black males.

With respect to mortality decline during more recent periods, several interesting findings are evident. First, for black males (Table 3.6), cumulative additional population resulting from observed mortality decline since 1970 is *greater* than additional population attributable to declines since 1960. Of black males in 2000, 0.65 million (3.82 percent) are alive because of lower mortality since 1970, which exceeds the number alive attributed to mortality decline since 1960 by 137,000 persons. This result is not surprising since death rates among black males increased in most age groups 15 years and older between 1954 and 1968 (Crimmins 1981). Second, the decade-to-decade proportionate impact of cumulative deaths prevented and additional births on the actual population in 2000 is greater for mortality declines since 1960 and 1970 than mortality declines in the more recent past. In other words, mortality declines between 1960 and 1980 have had a greater impact on population size than mortality declines between 1980 and 2000.

Infectious and Parasitic Diseases

The cumulative effect of mortality change from all infectious and parasitic diseases combined has been population loss for all race-sex groups. Relative to the scenario with mortality from these causes fixed at 1960 levels, population growth is greater under observed conditions until 1990, but the cumulative impact is negative by 2000. Mortality declines

from all infectious and parasitic diseases after 1970 added population during the 1970-80 period for all groups except white females, but the net effect since 1980 has been population loss. Cumulative population growth attributable to mortality change from all infectious and parasitic since 1960 is shown for each race-sex group in Figure 3.2.[9] Increases in infectious and parasitic disease mortality since 1980 had the most pronounced impact on the size of the population. If death rates from all infectious and parasitic diseases remained constant at 1980 levels, there would be an additional 237,000 white males (0.21 percent), 106,000 black males (0.62 percent), 63,000 white females (0.05 percent), and 40,000 black females (0.22 percent) alive today.

These aggregate trends reflect population gain from declines in tuberculosis mortality and population loss from increases in mortality from other infectious and parasitic diseases, especially HIV/AIDS mortality. Declines in **tuberculosis** mortality since 1960 added 123,000 white males (0.11 percent of the actual population), 54,000 white females (0.05 percent), 43,000 black males (0.25 percent), and 31,000 black females (0.17 percent) to the 2000 population. Thus, the proportionate impact of lower tuberculosis mortality has been greater for blacks than for whites. Death rates from **HIV infection** increased throughout much of the 1980s, but made significant declines between 1990 and 1997 for all groups other than black females (Table 3.2). The demographic impact of HIV-related mortality since its emergence soon after 1980 has been the cumulative loss of 198,000 white males, 96,000 black males, 32,000 black females, and 22,000 white females. The proportionate impact has

9 The same scale is used for all figures to facilitate comparison of the relative demographic impact of mortality change between each of the seven broad cause groups. Visual comparisons between race and sex groups are difficult in some of the figures because the absolute impact of mortality change has been much smaller for some cause groups than others.

been the greatest for black males (0.57 percent of the actual population), roughly equal for white males and black females (0.18 percent and 0.17 percent, respectively), but relatively minor for white females (0.02 percent). The rise in mortality from **other infectious and parasitic diseases** has varied by race, sex, and time period. The increase in mortality from these causes since 1960 had the greatest impact on population growth among white females, resulting in the loss of 55,000 persons by 2000. Losses among white males have been greatest since 1970, with higher mortality reducing the 2000 population by 47,000 persons. For blacks, the rise in mortality from other infectious and parasitic diseases since 1980 had the largest impact, reducing the 2000 population by 12,000 males and 10,000 females.

Cancer

The rise in cancer mortality since 1960, as shown in Table 3.2, has resulted in population loss for all race-sex groups. If cancer mortality remained fixed at 1960 levels, an additional 261,000 white males, 115,000 white females, 108,000 black males, and 16,000 black females would be alive today. Cumulative population loss by decade from increases in cancer mortality is shown in Figure 3.3. The proportionate impact of the escalation in cancer mortality has been greatest for black males, with losses accounting for 0.64 percent of the actual population in 2000, followed by white males (0.23 percent), white females (0.10 percent), and black females (0.09 percent). Total and proportionate population losses by 2000 would have been greater for white females (191,000; 0.17 percent) and black females (22,000; 0.12 percent) if mortality from cancer remained constant from 1970 onwards. Losses from deaths were partially offset by additional births resulting from declines in cancer

mortality at younger ages. For males, the trend of population losses reverses by the end of 1990-2000, as evidenced by the greater increase in population during this decade under observed conditions than under conditions holding cancer mortality fixed at 1980 and 1990 levels. There have been declines in cancer mortality for black females since 1990, whereas cancer mortality increased between 1970 and 2000 for white females.

The demographic impact of mortality change for specific types of cancer varies greatly by race and sex. The first two cancer groups are comprised of cancers causally linked to smoking (Klebba 1982). Observed declines in mortality from **cancer of the buccal cavity, pharynx, esophagus, and larynx** between 1960 and 1990 contributed to positive population growth for white males, but there were slight increases in mortality in the most recent decade. For all other race-sex groups, increases in mortality from these cancers between 1960 and 1980 resulted in population loss, but mortality improved during the past two decades. The cumulative impact of mortality change since 1960 for cancer of the buccal cavity, pharynx, esophagus, and larynx has been the addition of 16,000 white males (0.01 percent), but the loss of 14,000 black males (0.08 percent), 11,000 white females (0.01 percent), and 6,000 black females (0.03 percent). Mortality from **cancer of the trachea, bronchus, and lung**, the leading cause of cancer mortality (Garfinkel and Silverberg 1990), increased from 1960 to 2000 for all race-sex groups (except for males in the most recent decade), resulting in substantial population losses. Increases in lung cancer mortality since 1960 has resulted in the loss of 522,000 white females (0.45 percent of the actual population in 2000), 412,000 white males (0.37 percent), 52,000 black females (0.28 percent), and 77,000 black males (0.45 percent). These losses were comprised almost entirely of deaths,

though there were also fewer births as a result of higher lung cancer mortality. The increase in lung cancer mortality has abated since 1990 for males but not for females.

Mortality from **other avoidable forms of cancer** has declined substantially since 1960 for all race-sex groups except black males. Of those alive in 2000, 439,000 white females (0.38 percent of the actual population), 152,000 white males (0.14 percent), 41,000 black females (0.23 percent), and less than 1,000 black males (0.00 percent) are alive because of declines in mortality from other avoidable cancers between 1960 and 2000. Additional deaths due to higher mortality among black males were more than offset by additional births. Mortality from **all other forms of cancer** increased over much of the past forty years, with fewer people alive in 2000 under observed conditions than would have been alive under any of the fixed-mortality scenarios (except for more favorable conditions among white males with mortality fixed at 1990 levels).

Circulatory Diseases

Overall mortality declines since 1960 were driven by declines for circulatory diseases (Crimmins 1981; NCHS 1999a), so it is not surprising that lower mortality from these causes had a larger impact on the size of the population than that of all other causes combined.[10] Because of declines in mortality from all circulatory diseases since 1960, there were an additional 3.52 million white males (3.17 percent of the actual population), 3.50 million

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10 Mortality declines from all medically avoidable causes combined (discussed below) had a larger proportionate impact on the population of blacks than declines from all circulatory diseases combined. However, these broad cause groups are not mutually exclusive: cerebrovascular disease, rheumatic fever and chronic rheumatic heart disease, and hypertensive disease are included in the medically avoidable cause category.

white females (3.04 percent), 0.56 million black females (3.09 percent), and 0.35 million black males (2.07 percent) alive in 2000. As Figure 3.4 shows, cumulative population growth over time has converged for white males and females but diverged from black males and females. As the preceding numbers in parentheses indicate, the proportionate impact of declines in circulatory disease mortality was smallest for black males, while the impact was similar for other race-sex groups. Dividing cumulative population growth resulting from declines in all-cause mortality since 1960 by cumulative population growth resulting from declines in circulatory disease mortality provides an estimate of the proportion of total population growth attributable to improvements for circulatory diseases alone. Declines in circulatory disease mortality since 1960 are responsible for 87.3 percent of total population growth for white females, 82.5 percent for white males, 68.7 percent for black males, and 61.1 percent for black females.[11] With respect to time period, mortality declines since 1970 had the greatest cumulative impact from decade to decade.

Declines in mortality from **cerebrovascular disease** (stroke) since 1960 had the greatest proportionate impact for females, with 1.28 percent of black women (234,000 persons) and 1.04 percent of white women (1,196,000) alive in 2000 as a result of these improvements. Lower mortality from stroke had a larger impact on the size of the black female population than any other single condition. Of males alive in 2000, 0.79 percent of blacks (134,000) and 0.72 percent of whites (806,000) owe their existence or survival to declines in stroke mortality over the past forty years. Mortality declines from **rheumatic**

11 The counterfactual projections do not assure that population growth resulting from declines for specific or broad cause groups will sum to population growth for all causes combined, thus these percentage estimates are approximate.

fever and chronic rheumatic heart disease resulted in more modest increases in population, with the proportionate impact on the 2000 population being similar for all race-sex groups. Lower mortality from these causes since 1960 added 198,000 white females (0.17 percent), 181,000 white males (0.16 percent), 26,000 black females (0.14 percent), and 22,000 black males (0.13 percent) to the population.

The reduction in mortality from **ischemic heart disease** had a larger impact on the white population in 2000 than any other single condition. An additional 1.67 million white females and 2.47 million white males were alive at the turn of the century because of declines in ischemic heart disease mortality since 1960. This cumulative population growth represents 1.45 percent and 2.22 percent of the actual population of white females and males, respectively. Though the proportionate impact of decreases in ischemic heart disease mortality was smaller for blacks, mortality improvements contributed to considerable population growth. Declines since 1960 contributed an additional 120,000 black females (0.66 percent) and 122,000 black males (0.72 percent) to the 2000 population. Because of the stagnation or rise in mortality throughout much of the 1960s (as well as classification and coding changes in the ICD), the impact of declines in ischemic heart disease mortality since 1970 have been greater than those since 1960. Of the actual population in 2000, 2.01 million white females (1.75 percent), 2.65 million white males (2.38 percent), 0.27 million black females (1.50 percent), and 0.26 million black males (1.51 percent) were alive because of the reduction in ischemic heart disease mortality since 1970. The absolute and proportionate impact of lower ischemic heart disease mortality since 1970 was greater than that of any other single condition during any time period.

Trends in **hypertensive disease** mortality generally had a favorable impact on the population. Exceptions to this pattern include population losses under observed conditions for blacks between 1980 and 2000 relative to hypertensive disease mortality being fixed at 1970 levels and modest losses for all race-sex groups from increases in mortality since 1990. Results for hypertensive disease which span ICD revisions may be seriously distorted because of changes in coding practices. The comparability ratios in Table A3.1 (see Appendix) with the greatest deviation from 1.0 are for this cause group: 0.394 (between Seventh and Eighth Revisions) and 2.062 (between Eighth and Ninth Revisions).

Declines in **atherosclerosis** mortality since 1960 added 320,000 white females (0.28 percent of the actual population), 174,000 white males (0.16 percent), 28,000 black females (0.15 percent), and 19,000 black males (0.11 percent) to the 2000 population. In contrast, increases in mortality from **other circulatory diseases** since 1960 led to population losses across the board, with the greatest proportionate impact on black males and black females. Mortality improvements for these causes since 1990 slightly offset earlier losses for blacks and for white males, whereas mortality continued to increase for white females.

External Causes

Mortality from all external causes combined improved from 1960 onwards for all race-sex groups except black males. Losses among black males due to higher mortality from these causes accounted for 0.30 percent (52,000) of those alive in 2000. The proportionate impact of lower mortality from external causes since 1960 was greatest for black females, accounting for 0.12 percent (22,000) of those alive in 2000. Relative to the scenario with

mortality from external causes fixed at 1960 levels, observed conditions resulted in population losses for whites between 1960 and 1990, but positive cumulative population growth by 2000. Figure 3.5 displays cumulative population change by decade resulting from mortality change since 1960 in each race-sex group.

Since external mortality is highest among those in young and middle adulthood, higher death rates at these ages can result in substantial numbers of unrealized births even though cumulative population growth and prevented deaths are positive. Gains to the white population from declines in mortality from external causes were substantially offset by fewer births as a result of higher mortality at reproductive ages. Declines in external mortality since 1960 among whites prevented a total of 87,000 female deaths and 57,000 male deaths, but these were balanced against 53,000 fewer female births and 56,000 fewer male births. Mortality from all external causes has declined steadily since 1970 for all race-sex groups, thus contributing to positive population growth. Declines over the past thirty years had the greatest proportionate impact among black males, accounting for 210,000 (1.24 percent) of those alive in 2000. Additions to the population include 75,000 black females (0.41 percent), 436,000 white males (0.39 percent), and 264,000 white females (0.23 percent).

Changes in mortality from **motor vehicle accidents** since 1960 resulted in losses for some groups and gains for others. Sixteen-hundred fewer black females were alive in 2000 because nearly 400 cumulative prevented deaths were outweighed by 2,000 fewer births. The 57,000 fewer white females alive in 2000 because of higher motor vehicle accident mortality since 1960 was the result of 27,000 additional deaths and 30,000 fewer births. Cumulative population growth was positive for males, adding 35,000 white males (67,000

prevented deaths minus 32,000 unrealized births) and 13,000 black males (15,000 prevented deaths minus 2,000 unrealized births) to the population. Except for modest increases among black females after 1980, trends in motor vehicle accident mortality since 1970 were favorable for all race-sex groups.

Trends in **suicide** mortality since 1960 varied greatly by race and sex (Table 3.2). Comparing population change between observed and fixed-mortality conditions shows consistent losses under observed conditions for black and white males. Although age-adjusted death rates from suicide declined between 1990 and 1997 for both groups (-8.5 percent for white males and -9.7 percent for black males–Table 3.2), only white males register positive population growth under observed conditions relative to holding death rates fixed at 1990 levels. Substantial increases in suicide death rates among white and black females between 1960 and 1970 (Table 3.2) are responsible for the population losses under observed conditions relative to those fixed at 1960 levels. Since 1970 declines in suicide mortality have contributed to positive population growth among females.

Mortality from **homicide and legal intervention** has improved since 1970 among blacks, contributing an additional 56,000 males (0.33 percent) and 12,000 females (0.06 percent) to the population. Mortality from these causes did not improve among whites until after 1980. Declines in homicide over the past twenty years added 31,000 white males (0.03 percent) and 5,000 white females (0.00 percent) to the population. Mortality from all **other accidents and injuries** has declined across the board since 1960 except for slight increases since 1990 among whites. Improvements in mortality from these causes since 1960 increased the size of the population by 187,000 white males (0.17 percent), 162,000 white

females (0.14 percent), 48,000 black males (0.28 percent), and 40,000 black females (0.22 percent). Declines in other accident and injury mortality since 1970 had a greater impact on the male population: 270,000 white males (0.24 percent) and 98,000 black males (0.58 percent).

Smoking and Alcohol-Related Diseases

The most devastating impact on the size of the U.S. population has been the rise in mortality since 1960 from diseases associated with smoking and alcohol consumption. This broad cause group combines oral and respiratory cancers and cirrhosis of the liver. Although smoking and alcohol consumption contribute to higher mortality from many causes of death (CDC 1990, 1993a, 1993b, 1997a), the causes included in this category have clear causal associations with these behaviors. Relative to mortality fixed at 1960 levels, observed conditions resulted in 524,000 fewer white females (0.45 percent of the actual population), 377,000 fewer white males (0.34 percent), 109,000 fewer black males (0.64 percent), and 62,000 fewer black females being alive in 2000. These cumulative population losses are shown in Figure 3.6. On the other hand, observed conditions over the past thirty years were more favorable than the scenario holding mortality constant at 1970 levels. Improvements in mortality since 1970 had the greatest proportional benefit for black males. Changes in mortality from smoking and alcohol-related diseases since 1970 contributed an additional 421,000 black males (2.47 percent), 909,000 white males (0.82 percent), 123,000 black females (0.67 percent), and 229,000 white females (0.20 percent) to the actual population in 2000. For blacks and white males, population gains from improvements in smoking and

alcohol-related mortality since 1970 more than offset cumulative losses incurred when comparing observed and fixed-mortality conditions since 1960. Mortality from all of these causes combined continued to improve for white and black males, but it worsened for black females between 1980 and 1990 and for white females after 1980.

Trends in mortality from specific smoking-related cancers were described above in the section on cancer and will not be repeated here. The cumulative effect of changes in mortality from **chronic liver disease and cirrhosis** since 1960 has been population increase among whites and population decrease among blacks. Relative to the scenario holding cirrhosis mortality fixed at 1960 levels, observed mortality resulted in cumulative population losses for whites between 1960 and 1990, but improvements in mortality since 1970 led to net gains by the end of the 1990-2000 period. Improvements in cirrhosis mortality since 1970 added 115,000 white males (0.10 percent), 67,000 white females (0.06 percent), 29,000 black males (0.17 percent), and 25,000 black females (0.14 percent) to the population.

Medically Avoidable Conditions

Some specific causes described above are considered medically avoidable. The following cause groups were combined to assess the demographic impact of mortality change from all medically avoidable conditions combined (cause group number from Table A3.1 in the Appendix shown in parentheses): tuberculosis (1); other infectious and parasitic diseases (3); cancer, other avoidable forms (6); diabetes mellitus (8); other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, and sense organ diseases (9); cerebrovascular disease (11); rheumatic fever and chronic rheumatic heart disease (12);

hypertensive disease (14); pneumonia and influenza (17); other respiratory diseases (18); other avoidable digestive and genitourinary diseases (20); certain causes of perinatal mortality (22); and other avoidable conditions (23).

Mortality from all medically avoidable causes combined improved steadily over the past four decades, leading to substantial population gains in all race-sex groups (except for losses among white females since 1990). Declines in mortality from these causes since 1960 added 3.15 million white females (2.73 percent of the actual population), 2.73 million white males (2.45 percent), 0.85 million black females (4.65 percent), and 0.67 million black males (3.91 percent) to the population. Thus, the proportionate demographic impact was greater for blacks than for whites, and within racial groups, greater for females. Cumulative population growth by decade from improvements in medically avoidable mortality is shown for each race-sex group in Figure 3.7.

As described earlier for circulatory diseases, the share of total population growth from all-cause mortality decline since 1960 attributable to declines in medically avoidable mortality can be estimated by dividing cumulative population growth from changes in medically avoidable mortality by cumulative population growth from changes in all-cause mortality. Of total population growth between 1960 and 2000 resulting from mortality change, the share attributable to medically avoidable causes was 78.6 percent for white females, 63.9 percent for white males, 92.1 percent for black females, and 129.6 percent for black males.[12]

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12 Cumulative population growth for black males resulting from declines in mortality from medically avoidable causes exceeds the cumulative population growth from declines in mortality from all causes combined, which leads to an attributable percentage in excess of 100. When all causes are combined, decreases in mortality from medically avoidable causes were partially offset by increases in mortality from other causes.

The cumulative effect of changes in mortality from **diabetes mellitus** since 1960 was population gain for all race-sex groups except black males. The additional 12,000 deaths among black males due to higher diabetes mortality were partially offset by 1,000 more births. Higher diabetes mortality since 1960 accounted for less than 1,000 additional deaths among black females and white males, but these losses were outweighed by gains from 1,000 additional black female births and 3,000 additional white male births. There were 92,000 prevented deaths and 3,000 additional births among white females. Diabetes mortality improved for all groups after 1970, adding population over the ensuing two to three decades, but mortality for this cause deteriorated after 1990, diminishing earlier population gains. For all race-sex groups, mortality since 1960 improved for the group of **other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, and sense organ diseases**, with the largest proportionate impact among blacks (0.11-0.12 percent of the actual population in 2000 versus 0.05 percent among whites).

Improvements in medically avoidable mortality would have had an even greater impact on the population if declines in mortality from most causes were not countered by increases in mortality from respiratory diseases. The most substantial population losses were from the rise in death rates from **pneumonia and influenza**. Juxtaposed against the gain of 100,000 black females (0.55 percent of the actual population in 2000) were losses of 1,013,000 white females (0.88 percent), 938,000 white males (0.84 percent), and 99,000 black males (0.58 percent) as a result of changes in pneumonia and influenza mortality since 1960. Increases in pneumonia and influenza mortality since 1980 diminished the population by 1,158,000 white females (1.01 percent), 1,095,000 million white males (0.99 percent),

187,000 million black males (1.10 percent), and 4,000 black females (0.02 percent). Mortality from **other respiratory diseases** also increased from 1960 onwards for most race-sex groups, but the impact was less than that for pneumonia and influenza. Additional deaths resulting from higher respiratory disease mortality were partially offset by additional births, except among white females.

The category of **other avoidable digestive and genitourinary diseases** includes conditions such as ulcers, appendicitis, hernia, cholelithiasis and cholecystitis, nephritis and nephrosis, and kidney infections. Trends in mortality for this collection of causes was favorable for all race-sex groups, with mortality declines since 1960 adding 292,000 white females (0.25 percent), 413,000 white males (0.37 percent), 68,000 black females (0.37 percent), and 73,000 black males (0.43 percent) to the population.

Certain causes of perinatal mortality, which overwhelming result in death during the first year of life, decreased in importance over time. The greatest proportionate impact of lower mortality from these causes was among blacks. An additional 152,000 black males (0.90 percent) and 118,000 black females (0.65 percent) were alive in 2000 because of improvements in perinatal mortality over the past four decades. Improvements in mortality from these causes had a larger absolute impact on white populations, adding 536,000 white males (0.48 percent) and 380,000 white females (0.33 percent) to the population.

The final group of medically avoidable causes, **all other avoidable conditions**, is an admixture of causes such as complications of pregnancy, childbirth, and the puerperium, diseases of the skin and subcutaneous tissues, certain musculoskeletal and connective tissue disorders, and congenital anomalies of the circulatory and digestive systems. Mortality from

these causes improved over time for all race-sex groups. Sizable population gains were realized from both prevented deaths and additional births. Mortality improvements since 1960 added 120,000 white females (94,000 prevented deaths and 25,000 prevented deaths), 119,000 white males (92,000 prevented deaths and 27,000 additional births), 42,000 black females (31,000 prevented deaths and 11,000 additional births), and 21,000 black males (10,000 prevented deaths and 11,000 additional births) to the 2000 population.

Other Causes

The last three cause groups are residual categories which span several ICD classification chapters. Mortality from **other endocrine, metabolic, immunity, nutritional, blood, nervous system, and sense organ diseases** deteriorated over time for all race-sex groups, with the greatest proportionate impact among whites. Higher mortality from these causes resulted in the cumulative loss of 271,000 white females (0.24 percent), 248,000 white males (0.22 percent), 17,000 black females (0.09 percent), and 10,000 black males (0.06 percent). Additional deaths among blacks were slightly compensated by additional births, whereas losses among whites were from additional deaths and foregone births.

Trends in mortality from **other digestive and genitourinary diseases** varied by race, sex, and time period. There were cumulative losses among white females because of increases in mortality, with 64,000 additional deaths being partially offset by 10,000 additional births. Changes in mortality from these causes since 1960 added 5,000 white males to the population, with 5,000 additional deaths being outweighed by 10,000 additional births. Relative to 1960 and 1970 conditions, observed mortality from other digestive and

genitourinary diseases prevented deaths and added births among black males and females. Mortality continued to improve over the past two decades for black males, but worsened for black females.

The final cause group, **all other causes**, includes mental disorders, non-avoidable diseases of the musculoskeletal system and connective tissue, non-avoidable congenital anomalies, and symptoms and ill-defined conditions. Mortality from these causes worsened over time for whites but has improved for blacks. Relative to conditions which fixed mortality from all other causes at 1960, observed conditions led to the cumulative loss of 119,000 white females and 94,000 white males. Nearly 1,400 cumulative deaths prevented among black males were almost exactly counterbalanced by unrealized births. In contrast, improvements in mortality since 1960 from these causes added 26,000 black females. Mortality improvements since 1970 added 87,000 more blacks to the population, almost evenly split among males and females. The only gains among whites were relative to 1980 levels for males.

CONCLUSION

This study has employed a counterfactual population projection approach to assess the demographic consequences of changes in cause-specific mortality between 1960 and 2000. The 28 cause groups examined are comprised of leading causes of death, medically avoidable conditions, diseases associated with smoking and alcohol consumption, violent causes, and other causes of death. Cause groups are aggregated into broader groups to examine the consequences of mortality change for all causes combined, all infectious and

parasitic diseases, all cancers, all circulatory diseases, all external causes, smoking and alcohol-related diseases, and all medically avoidable conditions. Cumulative population gains or losses resulting from changes in mortality are estimated by way of difference between race-sex-specific populations projected under observed mortality conditions and populations projected while holding mortality constant for each cause. Population gains are decomposed into prevented deaths and additional births, or, in the case of population losses, additional deaths and unrealized births. Fixed-mortality scenarios hold mortality for specific and broad cause groups constant at 1960, 1970, 1980, and 1990 levels. Key findings from this analysis are summarized below.

A central objective of this study has been to compare not only the effects of mortality change for different causes of death, but to examine the relative impact of these changes for different race and sex groups. Consistent with having the largest absolute and proportionate increase in life expectancy at birth between 1960 and 1998 (8.9 years and 13.5 percent–Table 3.1), black females enjoyed the greatest proportionate benefit of declines in mortality from all causes combined since 1960. Five percent of black females alive in 2000 owe their existence or survival to these declines, whereas the proportionate addition to the population was 3.84 percent for white males, 3.48 percent for white females, and 3.02 percent for black males.

The total impact of mortality decline from all causes since 1960 was the addition of 8.28 million whites and 1.43 million blacks to the population by 2000. The enormous population gains from declines in circulatory disease and medically avoidable mortality were partially offset by population losses from increases in infectious and parasitic disease

(especially HIV infection) and cancer (especially lung cancer) mortality. Population gains attributable to declines in all circulatory diseases had a comparable proportionate impact for whites and black females (3.04-3.17 percent of the actual population in 2000), but less of an impact for black males (2.07 percent). Declines in medically avoidable mortality since 1960 had a much larger proportionate impact on the black population than on the white population. Of the black population in 2000, 4.65 percent of females and 3.91 percent of males were alive because of the reduction in mortality from medically avoidable conditions over the past forty years. Comparable figures for whites are 2.73 percent for females and 2.45 percent for males. Expanded access to medical care through Medicaid and Medicare may have been a greater boon to population health among blacks than among whites by reducing racial disparities in health coverage.

Changes in mortality from specific causes of death did not consistently favored any one race-sex group. With regard to infectious and parasitic diseases, declines in tuberculosis mortality had the greatest proportionate benefit for black males (0.25 percent of the actual population in 2000 versus 0.17 percent for black females, 0.11 percent for white males, and 0.05 percent for white females), but increases in mortality from HIV infection were most detrimental for black males (losses accounting for 0.57 percent versus 0.18 percent for white males, 0.17 percent for black females, and 0.02 percent for white females). The rise in cancer mortality was also the most deleterious for black males (0.64 percent versus 0.23 percent for white males, 0.10 percent for white females, and 0.09 percent for black females). Although proportionate losses from lung cancer, the leading cause of cancer deaths, were equal for black males and white females (0.45 percent), losses among white females were

offset by gains from greater declines in avoidable forms of cancer (0.38 percent versus 0.00 percent for black males).

Among leading causes of circulatory disease mortality, declines in cerebrovascular disease mortality after 1960 favored females, accounting for 1.28 percent of black females and 1.04 percent of white females alive in 2000 versus 0.79 percent for black males and 0.72 percent for white males. The drop in ischemic heart disease death rates after 1970, which had a larger proportionate impact on the population than declines from any other single condition, was most beneficial for whites, accounting for 2.38 percent of white males and 1.75 percent of white females alive in 2000 versus 1.5 percent for blacks.

Another broad set of causes with sharp contrasts between race-sex groups is external causes. Following increases or modest declines between 1960 and 1970, mortality from external causes fell precipitously after 1970. Black males experienced the greatest proportionate benefit from these declines, which account for 1.24 percent of those alive in 2000 versus 0.41 percent for black females, 0.39 percent for white males, and 0.23 percent for white females. With regard to specific external causes, declines in mortality from motor vehicle accidents, homicide and legal intervention, and other accidents and injuries after 1970 all had a larger proportionate impact on black males. Increases in suicide mortality resulted in consistent population losses for males, but females experienced population gains from lower suicide mortality after 1970.

The imprint on today's population left by mortality associated with smoking and alcohol consumption differs sharply by race and sex. White females suffered the greatest losses, with the combined effect of changes in mortality from oral and respiratory cancers

and cirrhosis since 1960 being the loss of 524,000 persons. Improvements in mortality from these causes relative to 1970 levels offset these losses by 230,000 persons, but increases after 1980 reduced the population by another 152,000. Though there were population losses relative to mortality conditions for these causes in 1960 for blacks and white males, improvements since 1970 produced gains outweighing earlier losses. Subtracting cumulative losses measured against conditions fixed at 1960 levels from cumulative gains measured against conditions fixed at 1970 levels indicates that improvements in smoking and alcohol-related mortality added 532,000 white males, 311,000 black males, and 61,000 black females to the population.

The most consistent deterioration in mortality over time was for pneumonia and influenza, though black females diverged from this pattern. Higher mortality from pneumonia and influenza over the last two decades reduced the size of the population by 1,158,000 white females, 1,095,000 white males, and 187,000 black males, with the proportionate impact being about 1.0 percent of the actual population for all three race-sex groups. In contrast, increases in mortality over the same period contributed to the loss of only 4,000 black females (0.02 percent of the actual population in 2000), which is heavily outweighed by the gain of 100,000 black females because of declines in pneumonia and influenza mortality since 1960.

Several caveats of this study should be noted. First, the estimates of the demographic consequences of cause-specific mortality change presented herein are approximations based on counterfactual population projections. The "actual" populations to which the fixed-mortality projections are compared are the result of projecting the 1960 population forward

in five-year intervals to 2000. Such projections assume that life table survival ratios at the beginning of each projection interval prevail over the ensuing five years rather than exposing the population to observed mortality conditions in each year. Furthermore, as White and Preston (1996) note in their investigation of mortality change throughout the entire twentieth century, these results

> present a formal demonstration of the effects of mortality change on population size and structure, assuming all else remained constant. If mortality had not changed, however, everything else might *not* have been constant. Immigrants might not have been as motivated to come to an unhealthy America, and fertility almost certainly would not have fallen as much if more children died. These interactions are not included in the exercise, whose objective is to isolate the first-order effects of mortality change on the actual population (427).

Though the impact of immigration and fertility decline were not as dramatic during the past forty years as in the previous sixty, fertility rates and net migration flows applied to the projections in the present study were observed under actual conditions and might have differed under various fixed-mortality regimes. Also, net migration estimates for the most recent decade, 1990-2000, were unavailable at the time of this study; substituting estimates for 1980-90 for the most recent decade adds imprecision.

Second, because practices for classifying and coding some causes of death changed between the three revisions of the ICD covered in this study, some of the results may be distorted. According to the comparability ratios shown in Table A3.1 (see Appendix), changes in the ICD resulted in differences between the number of deaths assigned to various cause groups which exceed 10 percent for the following causes: tuberculosis; other infectious and parasitic diseases; rheumatic fever and chronic rheumatic heart disease; ischemic heart disease; hypertensive disease; atherosclerosis; and other circulatory diseases. For many

cause groups in Table A3.1, comparability ratios are unavailable, so the potential degree of error is unknown. By grouping many smaller cause groups together, results for broad cause groups such as all cancers and all circulatory diseases are less susceptible to distortion from changes in the ICD. Furthermore, greater confidence may be placed in the results for specific cause groups with comparability ratios close to 1.0 (e.g., diabetes mellitus, cerebrovascular disease, chronic liver disease and cirrhosis, motor vehicle accidents, and homicide and legal intervention) and for comparisons of observed and fixed-mortality conditions after 1980 since all deaths were coded according to the Ninth Revision.

A final caveat pertains to the type of information which is presented in this study. The results in Tables 3.3-3.8 and Figures 3.1-3.7 focus on the total demographic impact of changes in cause-specific mortality by race, sex, and time period. However, mortality risks from many cause groups examined in this study also vary greatly by age. For example, perinatal mortality almost exclusively affects those in infancy, mortality from external causes is highest at young and middle adult ages, and mortality from chronic diseases such as heart disease is highest at older ages. The number of additional or unrealized births resulting from changes in cause-specific mortality provide a crude indicator of which age groups were affected. For instance, population gains among white males from prevented external deaths were almost exactly offset by foregone births, which suggests there were declines in external mortality at older ages but increases in mortality at younger ages. The relative impact of mortality declines on the age distribution of each race-sex group could be an area of inquiry in future research.

Although counterfactual population projections have been used to answer a number

of thought-provoking research questions in recent years (Heuveline 1997; White and Preston 1996; White 1999), the heuristic value of this approach is not widely appreciated. Assessing the impact of progress up to the present can be just as insightful, if not more so, than making guesses about what the impact of future progress.

TABLE 3.1 Life Expectancy at Birth by Race and Sex, 1900, 1960, and 1998

Year	White		Black		Female - Male		White - Black	
	Female	Male	Female	Male	White	Black	Female	Male
1900	48.7	46.6	33.5	32.5	2.1	1.0	15.2	14.1
1960	74.1	67.4	65.9	60.7	6.7	5.2	8.2	6.7
1998	80.0	74.5	74.8	67.6	5.5	7.2	5.2	6.9
Increase								
1900-60	25.4	20.8	32.4	28.2	3.4	2.8	-7.0	-7.4
1960-98	5.9	7.1	8.9	6.9	0.0	3.4	-3.0	-1.8
1900-98	31.3	27.9	41.3	35.1	3.4	6.2	-10.0	-7.2

SOURCE: National Center for Health Statistics (1999a, 2000).

TABLE 3.2 Cause-Specific Age-Adjusted Death Rates and Percent Change by Race, Sex, and Year, 1960-1997

Cause of Death	Age-Adjusted Death Rates					Percent Change			
	1960	1970	1980	1990	1997	1960-70	1970-80	1980-90	1990-97
					White Females				
Heart disease	197.1	167.8	134.6	103.1	90.4	-14.9	-19.8	-23.4	-12.3
Cerebrovascular disease	68.7	56.2	35.2	23.8	22.5	-18.2	-37.4	-32.4	-5.5
Cancer–all forms	109.5	107.6	107.7	111.2	106.0	-1.7	0.1	3.2	-4.7
Cancer–respiratory	5.1	10.1	18.2	26.5	28.0	98.0	80.2	45.6	5.7
HIV infection	--	--	--	1.1	1.0	--	--	--	-9.1
Motor vehicle accidents	11.1	14.4	12.3	11.0	10.3	29.7	-14.6	-10.6	-6.4
Suicide	5.3	7.2	5.7	4.8	4.4	35.8	-20.8	-15.8	-8.3
Homicide	1.5	2.2	3.2	2.8	2.3	46.7	45.5	-12.5	-17.9
					White Males				
Heart disease	375.4	347.6	277.5	202.0	168.7	-7.4	-20.2	-27.2	-16.5
Cerebrovascular disease	80.3	68.8	41.9	27.7	25.7	-14.3	-39.1	-33.9	-7.2
Cancer–all forms	141.6	154.3	160.5	160.3	145.9	9.0	4.0	-0.1	-9.0
Cancer–respiratory	34.6	49.9	58.0	59.0	51.4	44.2	16.2	1.7	-12.9
HIV infection	--	--	--	15.0	5.6	--	--	--	-62.7
Motor vehicle accidents	34.0	40.1	34.8	26.3	21.6	17.9	-13.2	-24.4	-17.9
Suicide	17.5	18.2	18.9	20.1	18.4	4.0	3.8	6.3	-8.5
Homicide	3.9	7.3	10.9	8.9	7.0	87.2	49.3	-18.3	-21.3
					Black Females				
Heart disease	282.6	251.7	201.1	168.1	147.6	-14.0	-20.1	-16.4	-12.2
Cerebrovascular disease	139.5	107.9	61.7	42.7	37.9	-22.7	-42.8	-30.8	-11.2
Cancer–all forms	127.8	123.5	129.7	137.2	131.2	-3.4	5.0	5.8	-4.4
Cancer–respiratory	5.5	10.9	19.5	27.5	28.3	98.2	78.9	41.0	2.9
HIV infection	--	--	--	9.9	13.3	--	--	--	34.3
Motor vehicle accidents	10.0	13.8	8.4	9.3	9.8	38.0	-39.1	10.7	5.4
Suicide	1.9	2.9	2.4	2.4	1.9	52.6	-17.2	0.0	-20.8
Homicide	11.8	15.0	13.7	13.0	9.3	27.1	-8.7	-5.1	-28.5
					Black Males				
Heart disease	381.2	375.9	327.3	275.9	236.2	-1.4	-12.9	-15.7	-14.4
Cerebrovascular disease	141.2	122.5	77.5	56.1	48.6	-13.2	-36.7	-27.6	-13.4
Cancer–all forms	158.5	198.0	229.9	248.1	214.8	24.9	16.1	7.9	-13.4
Cancer–respiratory	36.6	60.8	82.0	91.0	75.4	66.1	34.9	11.0	-17.1
HIV infection	--	--	--	44.2	38.5	--	--	--	-12.9
Motor vehicle accidents	38.2	50.1	32.9	28.9	24.9	31.2	-34.3	-12.2	-13.8
Suicide	7.8	9.9	11.1	12.4	11.2	26.9	12.1	11.7	-9.7
Homicide	44.9	82.1	71.9	68.7	48.3	82.9	-12.4	-4.5	-29.7

NOTE: ---, not available. Death rates are per 100,000 population.
SOURCE: National Center for Health Statistics (1999a).

TABLE 3.3 Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, White Females

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OBSERVED MORTALITY										
	1960-70	10490295			7109271			16130244		
	1970-80	17475207			14959866			29446926		
	1980-90	25403098			23514631			44353291		
	1990-00	32871656			33232437			59963364		
ALL CAUSES COMBINED										
Fixed at:	1960-70	10383528	106767	0.12	7216645	107374	0.12	16130851	-607	0.00
1960	1970-80	16502483	972724	0.97	15935579	975713	0.98	29449915	-2989	0.00
	1980-90	22961697	2441401	2.27	25937833	2423202	2.25	44335091	18199	0.02
	1990-00	28863221	4008435	3.48	37135036	3902599	3.39	59857528	105836	0.09
1970	1970-80	6649588	335323	0.34	8184570	333974	0.33	13315333	1350	0.00
	1980-90	13410750	1502052	1.39	17891005	1485645	1.38	28206639	16407	0.02
	1990-00	19552214	2829147	2.46	28887153	2763987	2.40	43767960	65160	0.06
1980	1980-90	7857060	70831	0.07	8624579	69815	0.06	14905348	1017	0.00
	1990-00	14782188	614261	0.53	18877436	604865	0.53	30507042	9396	0.01
1990	1990-00	7484444	-15885	-0.01	9701961	-15845	-0.01	15610114	-41	0.00
INFECTIOUS & PARASITIC DISEASES										
Fixed at:	1960-70	10485030	5265	0.01	7114417	5147	0.01	16130126	118	0.00
1960	1970-80	17460383	14824	0.01	14973840	13973	0.01	29446076	851	0.00
	1980-90	25392856	10242	0.01	23522065	7434	0.01	44350483	2808	0.00
	1990-00	32894326	-22670	-0.02	33204995	-27442	0.02	59958592	4772	0.00
1970	1970-80	6985101	-189	0.00	7850344	-251	0.00	13316620	62	0.00
	1980-90	14927447	-14645	-0.01	16390093	-15267	0.01	28222425	622	0.00
	1990-00	22438410	-57049	-0.05	26065266	-57900	0.05	43832269	851	0.00
1980	1980-90	7942971	-15080	-0.01	8539752	-15013	0.01	14906432	-68	0.00
	1990-00	15459123	-62674	-0.05	18211410	-61160	0.05	30517951	-1514	0.00
1990	1990-00	7478567	-10009	-0.01	9708039	-9767	0.01	15610315	-242	0.00
Tuberculosis–all forms										
Fixed at:	1960-70	10486591	3705	0.00	7112916	3645	0.00	16130185	59	0.00
1960	1970-80	17457284	17923	0.02	14977355	17489	0.02	29446492	434	0.00
	1980-90	25367342	35755	0.03	23549120	34489	0.03	44352025	1266	0.00
	1990-00	32818111	53545	0.05	33283317	50880	0.04	59960699	2665	0.00
1970	1970-80	6983388	1524	0.00	7852113	1517	0.00	13316676	6	0.00
	1980-90	14905522	7281	0.01	16412564	7204	0.01	28222970	76	0.00
	1990-00	22367955	13405	0.01	26136357	13191	0.01	43832905	215	0.00
1980	1980-90	7927515	376	0.00	8555142	377	0.00	14906365	-1	0.00
	1990-00	15394478	1971	0.00	18274549	1978	0.00	30516445	-7	0.00
1990	1990-00	7467957	601	0.00	9718404	598	0.00	15610071	3	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HIV infection										
Fixed at:	1960-70	10490295	0	0.00	7109271	0	0.00	16130244	0	0.00
1960	1970-80	17475207	0	0.00	14959866	0	0.00	29446926	0	0.00
	1980-90	25404140	-1042	0.00	23513634	-997	0.00	44353336	-46	0.00
	1990-00	32893342	-21686	-0.02	33212145	-20292	-0.02	59964758	-1394	0.00
1970	1970-80	6984911	0	0.00	7850596	0	0.00	13316682	0	0.00
	1980-90	14913844	-1042	0.00	16404364	-997	0.00	28223092	-46	0.00
	1990-00	22403047	-21686	-0.02	26102874	-20292	-0.02	43834514	-1394	0.00
1980	1980-90	7928933	-1042	0.00	8553768	-997	0.00	14906410	-46	0.00
	1990-00	15418135	-21686	-0.02	18252278	-20292	-0.02	30517832	-1394	0.00
1990	1990-00	7475222	-6663	-0.01	9711375	-6431	-0.01	15610306	-233	0.00
All other infectious & parasitic diseases										
Fixed at:	1960-70	10488735	1561	0.00	7110772	1501	0.00	16130185	59	0.00
1960	1970-80	17478311	-3105	0.00	14956346	-3521	0.00	29446510	416	0.00
	1980-90	25427625	-24527	-0.02	23488516	-26115	-0.02	44351703	1588	0.00
	1990-00	32926356	-54700	-0.05	33174235	-58201	-0.05	59959863	3501	0.00
1970	1970-80	6986625	-1713	0.00	7848827	-1769	0.00	13316626	56	0.00
	1980-90	14933698	-20895	-0.02	16383874	-21487	-0.02	28222455	591	0.00
	1990-00	22430176	-48815	-0.04	26072321	-50845	-0.04	43831090	2030	0.00
1980	1980-90	7942306	-14415	-0.01	8540371	-14394	-0.01	14906386	-21	0.00
	1990-00	15439411	-42961	-0.04	18229722	-42849	-0.04	30516550	-113	0.00
1990	1990-00	7472505	-3947	0.00	9713871	-3935	0.00	15610085	-12	0.00
CANCERS										
Fixed at:	1960-70	10483165	7130	0.01	7116346	7075	0.01	16130189	55	0.00
1960	1970-80	17463868	11339	0.01	14969931	10065	0.01	29445653	1273	0.00
	1980-90	25455471	-52373	-0.05	23455131	-59499	-0.06	44346165	7126	0.01
	1990-00	32986820	-115164	-0.10	33097079	-135358	-0.12	59943170	20194	0.02
1970	1970-80	6998622	-13711	-0.01	7836673	-13923	-0.01	13316470	212	0.00
	1980-90	15010252	-97450	-0.09	16305003	-100357	-0.09	28220140	2907	0.00
	1990-00	22571881	-190520	-0.17	25922647	-200519	-0.17	43823121	9999	0.01
1980	1980-90	7963683	-35792	-0.03	8518853	-35911	-0.03	14906245	119	0.00
	1990-00	15516579	-120129	-0.10	18150927	-121643	-0.11	30514923	1514	0.00
1990	1990-00	7473980	-5422	0.00	9712278	-5528	0.00	15609968	106	0.00
Cancer–buccal cavity, pharynx, esophagus, & larynx										
Fixed at:	1960-70	10490638	-343	0.00	7108927	-343	0.00	16130243	1	0.00
1960	1970-80	17480924	-5717	-0.01	14954130	-5736	-0.01	29446907	19	0.00
	1980-90	25414660	-11562	-0.01	23502984	-11647	-0.01	44353206	85	0.00
	1990-00	32882981	-11324	-0.01	33220906	-11531	-0.01	59963158	206	0.00
1970	1970-80	6985938	-1026	0.00	7849569	-1027	0.00	13316682	0	0.00
	1980-90	14916211	-3409	0.00	16401937	-3423	0.00	28223032	14	0.00
	1990-00	22382914	-1553	0.00	26121563	-1603	0.00	43833070	50	0.00
1980	1980-90	7927488	403	0.00	8555168	403	0.00	14906365	0	0.00
	1990-00	15393633	2816	0.00	18275388	2818	0.00	30516439	-2	0.00
1990	1990-00	7467480	1078	0.00	9718889	1083	0.00	15610078	-5	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cancer–trachea, bronchus, & lung										
Fixed at:	1960-70	10498446	-8150	-0.01	7101128	-8143	-0.01	16130252	-8	0.00
1960	1970-80	17558158	-82951	-0.08	14876980	-82886	-0.08	29446991	-65	0.00
	1980-90	25669362	-266264	-0.25	23248505	-266125	-0.25	44353430	-139	0.00
	1990-00	33393349	-521693	-0.45	32710981	-521456	-0.45	59963601	-237	0.00
1970	1970-80	7009045	-24134	-0.02	7826463	-24133	-0.02	13316683	-1	0.00
	1980-90	15077673	-164871	-0.15	16240457	-164903	-0.15	28223014	33	0.00
	1990-00	22769134	-387773	-0.34	25735258	-387908	-0.34	43832985	135	0.00
1980	1980-90	7964890	-36999	-0.03	8517760	-37005	-0.03	14906358	6	0.00
	1990-00	15581791	-185342	-0.16	18087176	-185394	-0.16	30516386	52	0.00
1990	1990-00	7492299	-23741	-0.02	9694064	-23742	-0.02	15610072	1	0.00
Cancer–other avoidable forms										
Fixed at:	1960-70	10477749	12547	0.01	7121795	12524	0.01	16130221	23	0.00
1960	1970-80	17362726	112481	0.11	15071576	111709	0.11	29446154	772	0.00
	1980-90	25150078	253020	0.23	23763571	248940	0.23	44349211	4080	0.00
	1990-00	32433020	438636	0.38	33659473	427036	0.37	59951764	11600	0.01
1970	1970-80	6974102	10809	0.01	7861296	10701	0.01	13316573	109	0.00
	1980-90	14835462	77341	0.07	16481138	75778	0.07	28221484	1563	0.00
	1990-00	22179205	202156	0.18	26319600	196434	0.17	43827397	5723	0.00
1980	1980-90	7921184	6707	0.01	8561400	6636	0.01	14906293	72	0.00
	1990-00	15321048	75402	0.07	18346932	74362	0.06	30515398	1040	0.00
1990	1990-00	7444467	24092	0.02	9741798	23992	0.02	15609974	100	0.00
Cancer–all other forms										
Fixed at:	1960-70	10487220	3076	0.00	7112307	3037	0.00	16130205	39	0.00
1960	1970-80	17487974	-12767	-0.01	14946552	-13314	-0.01	29446379	547	0.00
	1980-90	25432524	-29426	-0.03	23482104	-32527	-0.03	44350190	3101	0.00
	1990-00	32898170	-26513	-0.02	33197295	-35142	-0.03	59954735	8629	0.01
1970	1970-80	6984268	644	0.00	7851136	540	0.00	13316579	104	0.00
	1980-90	14919363	-6561	-0.01	16397502	-7858	-0.01	28221749	1298	0.00
	1990-00	22385251	-3890	0.00	26115183	-7983	-0.01	43829027	4093	0.00
1980	1980-90	7933782	-5891	-0.01	8548832	-5932	-0.01	14906323	42	0.00
	1990-00	15409397	-12947	-0.01	18259199	-13371	-0.01	30516014	424	0.00
1990	1990-00	7475406	-6848	-0.01	9710949	-6857	-0.01	15610064	10	0.00
CIRCULATORY DISEASES										
Fixed at:	1960-70	10403729	86567	0.09	7195750	86479	0.09	16130157	87	0.00
1960	1970-80	16661875	813332	0.81	15771663	811797	0.81	29445392	1535	0.00
	1980-90	23275985	2127113	1.97	25635054	2120423	1.97	44346601	6690	0.01
	1990-00	29373190	3498467	3.04	36715608	3483172	3.02	59948069	15295	0.01
1970	1970-80	6728371	256540	0.26	8106928	256332	0.26	13316474	208	0.00
	1980-90	13584979	1327823	1.23	17730478	1325118	1.23	28220341	2706	0.00
	1990-00	19784889	2596472	2.25	28711651	2588485	2.25	43825133	7987	0.01
1980	1980-90	7745621	182270	0.17	8736950	182185	0.17	14906280	85	0.00
	1990-00	14377148	1019302	0.88	19291045	1018475	0.88	30515611	827	0.00
1990	1990-00	7377675	90884	0.08	9808750	90944	0.08	15610134	-60	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cerebrovascular disease										
Fixed at:	1960-70	10454283	36013	0.04	7145285	36014	0.04	16130245	-1	0.00
1960	1970-80	17224844	250363	0.25	15210167	250301	0.25	29446864	62	0.00
	1980-90	24664210	738888	0.69	24252467	737837	0.68	44352240	1051	0.00
	1990-00	31675511	1196145	1.04	34425219	1192782	1.04	59960001	3363	0.00
1970	1970-80	6913291	71620	0.07	7922139	71543	0.07	13316605	77	0.00
	1980-90	14442891	469912	0.44	16874163	468803	0.44	28221937	1109	0.00
	1990-00	21510145	871215	0.76	26990803	867637	0.75	43829541	3579	0.00
1980	1980-90	7855792	72099	0.07	8626816	72051	0.07	14906317	48	0.00
	1990-00	15122837	273612	0.24	18545705	273135	0.24	30515961	477	0.00
1990	1990-00	7467349	1209	0.00	9718995	1189	0.00	15610053	20	0.00
Rheumatic fever & chronic rheumatic heart disease										
Fixed at:	1960-70	10482322	7973	0.01	7117038	7767	0.01	16130038	206	0.00
1960	1970-80	17430935	44272	0.04	15002316	42450	0.04	29445105	1822	0.00
	1980-90	25286477	116621	0.11	23625717	111086	0.10	44347756	5535	0.01
	1990-00	32673982	197674	0.17	33418759	186323	0.16	59952012	11352	0.01
1970	1970-80	6978523	6389	0.01	7856936	6340	0.01	13316633	49	0.00
	1980-90	14865368	47435	0.04	16452173	46813	0.04	28222424	622	0.00
	1990-00	22285200	96161	0.08	26217513	94347	0.08	43831306	1814	0.00
1980	1980-90	7923423	4467	0.00	8559221	4456	0.00	14906353	11	0.00
	1990-00	15373959	22491	0.02	18294962	22391	0.02	30516338	100	0.00
1990	1990-00	7465032	3527	0.00	9721334	3528	0.00	15610075	-1	0.00
Ischemic heart disease										
Fixed at:	1960-70	10504261	-13966	-0.02	7095334	-13937	-0.02	16130273	-29	0.00
1960	1970-80	17496964	-21757	-0.02	14938201	-21665	-0.02	29447018	-92	0.00
	1980-90	24627603	775495	0.72	24289859	775228	0.72	44353024	267	0.00
	1990-00	31200334	1671322	1.45	34902745	1670309	1.45	59962350	1014	0.00
1970	1970-80	6825547	159364	0.16	8009904	159309	0.16	13316626	56	0.00
	1980-90	13857152	1055651	0.98	17460400	1055039	0.98	28222435	611	0.00
	1990-00	20367626	2013735	1.75	28135189	2012023	1.75	43831408	1712	0.00
1980	1980-90	7797276	130615	0.12	8685371	130607	0.12	14906356	9	0.00
	1990-00	14703460	692989	0.60	18965442	692871	0.60	30516320	118	0.00
1990	1990-00	7373088	95470	0.08	9813297	95491	0.08	15610095	-21	0.00
Hypertensive disease										
Fixed at:	1960-70	10444270	46025	0.05	7155278	46008	0.05	16130227	17	0.00
1960	1970-80	17161077	314130	0.31	15273837	313970	0.31	29446766	160	0.00
	1980-90	24900935	502163	0.47	24016271	501640	0.47	44352768	522	0.00
	1990-00	32217892	653765	0.57	33885075	652638	0.57	59962238	1127	0.00
1970	1970-80	6970125	14787	0.01	7865369	14774	0.01	13316669	13	0.00
	1980-90	14901928	10875	0.01	16416123	10763	0.01	28222935	112	0.00
	1990-00	22364183	17178	0.01	26140049	16883	0.01	43832825	295	0.00
1980	1980-90	7918784	9107	0.01	8563865	9100	0.01	14906357	7	0.00
	1990-00	15374571	21879	0.02	18294408	21837	0.02	30516396	42	0.00
1990	1990-00	7476777	-8218	-0.01	9709594	-8212	-0.01	15610080	-6	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Atherosclerosis										
Fixed at:	1960-70	10486393	3903	0.00	7113175	3905	0.00	16130246	-2	0.00
1960	1970-80	17401407	73800	0.07	15033668	73802	0.07	29446929	-2	0.00
	1980-90	25215665	187433	0.17	23702054	187424	0.17	44353281	9	0.00
	1990-00	32551443	320214	0.28	33552622	320185	0.28	59963335	29	0.00
1970	1970-80	6970818	14093	0.01	7864688	14093	0.01	13316682	0	0.00
	1980-90	14826497	86305	0.08	16491659	86299	0.08	28223040	6	0.00
	1990-00	22195862	185498	0.16	26308645	185479	0.16	43833100	20	0.00
1980	1980-90	7909133	18758	0.02	8573521	18757	0.02	14906364	1	0.00
	1990-00	15312736	83714	0.07	18356279	83709	0.07	30516433	5	0.00
1990	1990-00	7461641	6917	0.01	9724724	6918	0.01	15610074	0	0.00
Other circulatory diseases										
Fixed at:	1960-70	10483522	6773	0.01	7116148	6877	0.01	16130348	-104	0.00
1960	1970-80	17309568	165639	0.17	15125919	166053	0.17	29447341	-415	0.00
	1980-90	25418063	-14965	-0.01	23500360	-14271	-0.01	44353985	-694	0.00
	1990-00	32945612	-73955	-0.06	33160067	-72370	-0.06	59964950	-1586	0.00
1970	1970-80	6993179	-8267	-0.01	7842316	-8280	-0.01	13316669	13	0.00
	1980-90	15247743	-334940	-0.31	16070175	-335185	-0.31	28222801	245	0.00
	1990-00	22903029	-521668	-0.45	25600928	-522238	-0.45	43832550	570	0.00
1980	1980-90	7980693	-52802	-0.05	8501954	-52811	-0.05	14906355	9	0.00
	1990-00	15451085	-54636	-0.05	18217849	-54721	-0.05	30516352	85	0.00
1990	1990-00	7476723	-8165	-0.01	9709692	-8114	-0.01	15610124	-51	0.00
EXTERNAL CAUSES										
Fixed at:	1960-70	10508275	-17980	-0.02	7092536	-16734	-0.02	16131490	-1246	0.00
1960	1970-80	17523278	-48071	-0.05	14923281	-36585	-0.04	29458412	-11486	-0.01
	1980-90	25422457	-19359	-0.02	23526541	11910	0.01	44384560	-31269	-0.03
	1990-00	32837655	34001	0.03	33319386	86949	0.08	60016312	-52948	-0.05
1970	1970-80	6958455	26457	0.03	7876803	26208	0.03	13316433	249	0.00
	1980-90	14783097	129705	0.12	16532917	127557	0.12	28220898	2149	0.00
	1990-00	22117545	263816	0.23	26376076	252910	0.22	43822214	10906	0.01
1980	1980-90	7908691	19200	0.02	8573355	18591	0.02	14905755	609	0.00
	1990-00	15317064	79385	0.07	18345850	73279	0.06	30510332	6106	0.01
1990	1990-00	7466934	1625	0.00	9719222	1416	0.00	15609865	208	0.00
Motor vehicle accidents										
Fixed at:	1960-70	10504057	-13761	-0.01	7096386	-12885	-0.01	16131121	-877	0.00
1960	1970-80	17508805	-33598	-0.03	14932865	-27001	-0.03	29453524	-6598	-0.01
	1980-90	25449124	-46026	-0.04	23485398	-29233	-0.03	44370084	-16793	-0.02
	1990-00	32928483	-56827	-0.05	33205788	-26649	-0.02	59993542	-30178	-0.03
1970	1970-80	6967695	17217	0.02	7867312	16716	0.02	13316182	500	0.00
	1980-90	14864674	48128	0.04	16450566	45206	0.04	28220124	2922	0.00
	1990-00	22297009	84352	0.07	26199586	76420	0.07	43825188	7932	0.01
1980	1980-90	7922971	4920	0.00	8559413	4648	0.00	14906093	271	0.00
	1990-00	15378645	17804	0.02	18287928	15357	0.01	30513991	2447	0.00
1990	1990-00	7466314	2245	0.00	9719858	2052	0.00	15609881	193	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Suicide										
Fixed at:	1960-70	10495656	-5360	-0.01	7104135	-5135	-0.01	16130469	-225	0.00
1960	1970-80	17499643	-24436	-0.02	14937552	-22314	-0.02	29449048	-2122	0.00
	1980-90	25434735	-31637	-0.03	23488808	-25822	-0.02	44359105	-5815	-0.01
	1990-00	32898059	-26403	-0.02	33215966	-16470	-0.01	59973297	-9933	-0.01
1970	1970-80	6984714	198	0.00	7850857	261	0.00	13316745	-63	0.00
	1980-90	14897396	15406	0.01	16420760	15400	0.01	28223041	6	0.00
	1990-00	22336706	44655	0.04	26166493	43327	0.04	43831792	1328	0.00
1980	1980-90	7925083	2808	0.00	8557437	2672	0.00	14906228	136	0.00
	1990-00	15377266	19183	0.02	18290456	17886	0.02	30515141	1297	0.00
1990	1990-00	7466215	2344	0.00	9720094	2288	0.00	15610018	55	0.00
Homicide & legal intervention										
Fixed at:	1960-70	10491400	-1105	0.00	7108237	-1033	0.00	16130316	-71	0.00
1960	1970-80	17486609	-11402	-0.01	14949560	-10306	-0.01	29448022	-1095	0.00
	1980-90	25431798	-28700	-0.03	23490525	-24106	-0.02	44357885	-4595	0.00
	1990-00	32916168	-44512	-0.04	33198083	-34353	-0.03	59973523	-10159	-0.01
1970	1970-80	6987854	-2943	0.00	7847798	-2798	0.00	13316827	-145	0.00
	1980-90	14924357	-11555	-0.01	16395440	-9920	-0.01	28224681	-1634	0.00
	1990-00	22399648	-18287	-0.02	26109103	-14063	-0.01	43837344	-4224	0.00
1980	1980-90	7926975	916	0.00	8555642	878	0.00	14906326	38	0.00
	1990-00	15391656	4793	0.00	18276954	4384	0.00	30516028	409	0.00
1990	1990-00	7467336	1223	0.00	9718968	1162	0.00	15610013	61	0.00
Other accidents & injuries										
Fixed at:	1960-70	10488048	2247	0.00	7111591	2320	0.00	16130317	-73	0.00
1960	1970-80	17453820	21387	0.02	14982921	23054	0.02	29448594	-1667	0.00
	1980-90	25316039	87058	0.08	23605743	91112	0.08	44357345	-4054	0.00
	1990-00	32709853	161803	0.14	33396897	164461	0.14	59966021	-2657	0.00
1970	1970-80	6972925	11987	0.01	7862626	12030	0.01	13316726	-43	0.00
	1980-90	14835016	77786	0.07	16482292	76932	0.07	28222192	855	0.00
	1990-00	22228047	153314	0.13	26270609	147443	0.13	43827250	5870	0.01
1980	1980-90	7917334	10557	0.01	8565158	10393	0.01	14906201	164	0.00
	1990-00	15358832	37618	0.03	18308235	35664	0.03	30514484	1953	0.00
1990	1990-00	7472745	-4187	0.00	9713720	-4086	0.00	15610174	-101	0.00
SMOKING & ALCOHOL-RELATED DISEASES										
Fixed at:	1960-70	10504003	-13708	-0.01	7095583	-13687	-0.01	16130264	-20	0.00
1960	1970-80	17587086	-111879	-0.11	14848102	-111764	-0.11	29447041	-115	0.00
	1980-90	25700943	-297846	-0.28	23216675	-297956	-0.28	44353180	111	0.00
	1990-00	33395487	-523830	-0.45	32707773	-524664	-0.46	59962530	834	0.00
1970	1970-80	6918700	66212	0.07	7911335	60739	0.06	13311209	5473	0.01
	1980-90	14757172	155631	0.14	16511469	106109	0.10	28173525	49521	0.05
	1990-00	22151965	229396	0.20	26222648	99482	0.09	43703206	129914	0.11
1980	1980-90	7958524	-30633	-0.03	8524102	-30663	-0.03	14906335	30	0.00
	1990-00	15548860	-152411	-0.13	18119870	-152701	-0.13	30516148	290	0.00
1990	1990-00	7488323	-19764	-0.02	9698030	-19776	-0.02	15610062	11	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chronic liver disease & cirrhosis										
Fixed at:	1960-70	10495509	-5213	-0.01	7104071	-5200	-0.01	16130257	-13	0.00
1960	1970-80	17498323	-23116	-0.02	14936819	-23047	-0.02	29446995	-69	0.00
	1980-90	25422612	-19514	-0.02	23494952	-19679	-0.02	44353126	164	0.00
	1990-00	32861479	10177	0.01	33241750	9313	0.01	59962500	864	0.00
1970	1970-80	6982418	2493	0.00	7853052	2457	0.00	13316645	37	0.00
	1980-90	14889279	23523	0.02	16428415	23055	0.02	28222578	468	0.00
	1990-00	22314623	66738	0.06	26188393	65227	0.06	43831609	1511	0.00
1980	1980-90	7921930	5961	0.01	8560702	5937	0.01	14906341	24	0.00
	1990-00	15366371	30078	0.03	18302409	29839	0.03	30516198	240	0.00
1990	1990-00	7465662	2897	0.00	9720688	2882	0.00	15610058	15	0.00
MEDICALLY AVOIDABLE CONDITIONS										
Fixed at:	1960-70	10345990	144306	0.16	7252781	143510	0.15	16129449	795	0.00
1960	1970-80	16493569	981638	0.98	15932158	972292	0.97	29437580	9346	0.01
	1980-90	23303256	2099841	1.95	25567324	2052694	1.91	44306143	47148	0.04
	1990-00	29722714	3148942	2.73	36232087	2999650	2.60	59814072	149292	0.13
1970	1970-80	6810456	174455	0.17	8024200	173604	0.17	13315831	852	0.00
	1980-90	14126865	785938	0.73	17180996	775636	0.72	28212745	10302	0.01
	1990-00	20991778	1389583	1.21	27469191	1346025	1.17	43789563	43557	0.04
1980	1980-90	7898039	29852	0.03	8584332	29567	0.03	14906080	284	0.00
	1990-00	15239569	156880	0.14	18426429	153859	0.13	30513417	3021	0.00
1990	1990-00	7481993	-13434	-0.01	9704269	-13537	-0.01	15609971	102	0.00
Diabetes mellitus										
Fixed at:	1960-70	10487710	2585	0.00	7111841	2571	0.00	16130229	15	0.00
1960	1970-80	17447732	27475	0.03	14987116	27249	0.03	29446700	226	0.00
	1980-90	25313872	89226	0.08	23602690	88059	0.08	44352124	1166	0.00
	1990-00	32776435	95221	0.08	33324848	92411	0.08	59960554	2810	0.00
1970	1970-80	6967863	17048	0.02	7867591	16995	0.02	13316629	53	0.00
	1980-90	14838525	74278	0.07	16479041	73681	0.07	28222450	597	0.00
	1990-00	22300774	80587	0.07	26202099	78933	0.07	43831466	1654	0.00
1980	1980-90	7924227	3664	0.00	8558419	3654	0.00	14906355	9	0.00
	1990-00	15422201	-25752	-0.02	18246768	-25802	-0.02	30516387	50	0.00
1990	1990-00	7479785	-11227	-0.01	9706578	-11227	-0.01	15610073	1	0.00
Other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	10487537	2759	0.00	7111992	2721	0.00	16130207	37	0.00
1960	1970-80	17462790	12417	0.01	14971812	11946	0.01	29446456	470	0.00
	1980-90	25370728	32370	0.03	23544841	30210	0.03	44351131	2160	0.00
	1990-00	32818120	53537	0.05	33280128	47692	0.04	59957519	5845	0.01
1970	1970-80	6982304	2607	0.00	7853159	2563	0.00	13316638	44	0.00
	1980-90	14897558	15244	0.01	16420041	14681	0.01	28222483	563	0.00
	1990-00	22352657	28704	0.02	26149888	26722	0.02	43831137	1982	0.00
1980	1980-90	7927409	482	0.00	8555213	449	0.00	14906331	34	0.00
	1990-00	15393719	2731	0.00	18274986	2416	0.00	30516123	315	0.00
1990	1990-00	7469080	-522	0.00	9717265	-541	0.00	15610055	19	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Pneumonia & influenza										
Fixed at:	1960-70	10678615	-188319	-0.20	6921431	-187840	-0.20	16130724	-479	0.00
1960	1970-80	17773536	-298329	-0.30	14664161	-295705	-0.30	29449550	-2624	0.00
	1980-90	26122535	-719437	-0.67	22798807	-715824	-0.66	44356904	-3614	0.00
	1990-00	33885112	-1013455	-0.88	32218608	-1013828	-0.88	59962991	373	0.00
1970	1970-80	7225005	-240093	-0.24	7611843	-238752	-0.24	13318023	-1341	0.00
	1980-90	15643385	-730583	-0.68	15678467	-726893	-0.67	28226737	-3690	0.00
	1990-00	23457068	-1075708	-0.93	25052333	-1070833	-0.93	43837995	-4875	0.00
1980	1980-90	8606195	-678304	-0.63	7878038	-676726	-0.63	14907943	-1578	0.00
	1990-00	16554705	-1158256	-1.01	17119949	-1152621	-1.00	30522073	-5635	0.00
1990	1990-00	7931779	-463220	-0.40	9255516	-462290	-0.40	15611004	-931	0.00
Other respiratory diseases										
Fixed at:	1960-70	10495295	-4999	-0.01	7104268	-5003	-0.01	16130240	4	0.00
1960	1970-80	17511548	-36341	-0.04	14923400	-36466	-0.04	29446801	125	0.00
	1980-90	25566639	-163541	-0.15	23349849	-164782	-0.15	44352049	1241	0.00
	1990-00	33237992	-366336	-0.32	32861477	-370960	-0.32	59958740	4624	0.00
1970	1970-80	6994738	-9826	-0.01	7840714	-9882	-0.01	13316626	56	0.00
	1980-90	15034215	-121413	-0.11	16283403	-121957	-0.11	28222502	544	0.00
	1990-00	22699015	-317654	-0.28	25803745	-319421	-0.28	43831353	1767	0.00
1980	1980-90	7975048	-47157	-0.04	8507601	-47163	-0.04	14906358	7	0.00
	1990-00	15602149	-205700	-0.18	18066903	-205668	-0.18	30516470	-32	0.00
1990	1990-00	7504269	-35711	-0.03	9682116	-35690	-0.03	15610094	-21	0.00
Other avoidable digestive & genitourinary diseases										
Fixed at:	1960-70	10483684	6612	0.01	7115784	6514	0.01	16130146	98	0.00
1960	1970-80	17380778	94429	0.09	15052746	92879	0.09	29445376	1550	0.00
	1980-90	25213795	189303	0.18	23697828	183197	0.17	44347184	6106	0.01
	1990-00	32579309	292347	0.25	33510741	278304	0.24	59949321	14043	0.01
1970	1970-80	6961815	23097	0.02	7873560	22964	0.02	13316549	133	0.00
	1980-90	14849876	62927	0.06	16466943	61583	0.06	28221703	1344	0.00
	1990-00	22262160	119201	0.10	26238436	115270	0.10	43829189	3931	0.00
1980	1980-90	7928113	-222	0.00	8554516	-249	0.00	14906338	27	0.00
	1990-00	15374590	21859	0.02	18294140	21569	0.02	30516148	290	0.00
1990	1990-00	7464475	4083	0.00	9721897	4091	0.00	15610081	-8	0.00
Certain causes of perinatal mortality										
Fixed at:	1960-70	10472001	18294	0.02	7127565	18294	0.02	16130244	0	0.00
1960	1970-80	17393661	81546	0.08	15041187	81321	0.08	29446701	225	0.00
	1980-90	25202727	200371	0.19	23706705	192074	0.18	44344994	8297	0.01
	1990-00	32491694	379962	0.33	33565713	333277	0.29	59916678	46686	0.04
1970	1970-80	6966693	18219	0.02	7868814	18218	0.02	13316681	1	0.00
	1980-90	14831879	80923	0.08	16486008	80648	0.07	28222771	276	0.00
	1990-00	22201589	179772	0.16	26293949	170783	0.15	43824131	8989	0.01
1980	1980-90	7918510	9381	0.01	8564146	9382	0.01	14906365	-1	0.00
	1990-00	15353223	43226	0.04	18315667	43096	0.04	30516308	130	0.00
1990	1990-00	7463195	5364	0.00	9723169	5363	0.00	15610073	0	0.00

(continued)

TABLE 3.3 Components of Population Change, 1960-2000, White Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
All other avoidable conditions										
Fixed at:	1960-70	10484620	5675	0.01	7114720	5450	0.01	16130019	225	0.00
1960	1970-80	17439524	35683	0.04	14992984	33117	0.03	29444360	2566	0.00
	1980-90	25333322	69776	0.06	23574530	59900	0.06	44343414	9876	0.01
	1990-00	32752067	119589	0.10	33326684	94248	0.08	59938023	25341	0.02
1970	1970-80	6980502	4409	0.00	7854861	4265	0.00	13316538	144	0.00
	1980-90	14904976	7826	0.01	16411854	6493	0.01	28221714	1333	0.00
	1990-00	22360127	21234	0.02	26139729	16563	0.01	43828449	4671	0.00
1980	1980-90	7925961	1930	0.00	8556627	1862	0.00	14906297	68	0.00
	1990-00	15387205	9245	0.01	18281272	8701	0.01	30515894	543	0.00
1990	1990-00	7467628	930	0.00	9718731	925	0.00	15610068	5	0.00
Other endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at;	1960-70	10502817	-12521	-0.01	7096819	-12451	-0.01	16130314	-70	0.00
1960	1970-80	17521710	-46503	-0.05	14914254	-45613	-0.05	29447817	-891	0.00
	1980-90	25536097	-132999	-0.12	23385316	-129315	-0.12	44356975	-3684	0.00
	1990-00	33142562	-270905	-0.24	32970890	-261546	-0.23	59972723	-9359	-0.01
1970	1970-80	6984518	394	0.00	7850977	381	0.00	13316669	13	0.00
	1980-90	14957937	-45135	0.04	16360108	-45252	-0.04	28222929	118	0.00
	1990-00	22522438	-141077	0.12	25981661	-141505	-0.12	43832693	427	0.00
1980	1980-90	7947636	-19746	0.02	8534974	-19791	-0.02	14906319	45	0.00
	1990-00	15495520	-99070	0.09	18173151	-99419	-0.09	30516089	349	0.00
1990	1990-00	7495288	-26730	0.02	9691117	-26689	-0.02	15610115	-41	0.00
Other digestive & genitourinary diseases										
Fixed at:	1960-70	10491834	-1539	0.00	7107693	-1577	0.00	16130205	39	0.00
1960	1970-80	17486383	-11176	0.01	14948273	-11593	-0.01	29446509	417	0.00
	1980-90	25439451	-36353	0.03	23475281	-39350	-0.04	44350294	2996	0.00
	1990-00	32925855	-54199	0.05	33168372	-64064	-0.06	59953498	9866	0.01
1970	1970-80	6985050	-138	0.00	7850386	-210	0.00	13316611	72	0.00
	1980-90	14932604	-19801	-0.02	16384631	-20729	-0.02	28222118	928	0.00
	1990-00	22419835	-38474	-0.03	26081968	-41198	-0.04	43830395	2725	0.00
1980	1980-90	7937815	-9924	-0.01	8544821	-9943	-0.01	14906346	19	0.00
	1990-00	15422922	-26472	-0.02	18245914	-26656	-0.02	30516254	184	0.00
1990	1990-00	7470655	-2097	0.00	9715720	-2086	0.00	15610084	-10	0.00
All other causes										
Fixed at:	1960-70	10492526	-2230	0.00	7107099	-2172	0.00	16130303	-59	0.00
1960	1970-80	17502372	-27165	-0.03	14933539	-26327	-0.03	29447765	-839	0.00
	1980-90	25460990	-57892	-0.05	23458733	-55897	-0.05	44355286	-1995	0.00
	1990-00	32990304	-118648	-0.10	33118132	-114305	-0.10	59967707	-4343	0.00
1970	1970-80	6992621	-7709	-0.01	7842930	-7665	-0.01	13316726	-44	0.00
	1980-90	14934468	-21666	-0.02	16383406	-21954	-0.02	28222758	288	0.00
	1990-00	22448688	-67327	-0.06	26054938	-68228	-0.06	43832219	901	0.00
1980	1980-90	7936447	-8556	-0.01	8546194	-8571	-0.01	14906349	15	0.00
	1990-00	15448741	-52292	-0.05	18220071	-52500	-0.05	30516230	208	0.00
1990	1990-00	7504693	-36135	-0.03	9681687	-36119	-0.03	15610089	-16	0.00

TABLE 3.4 Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, White Males

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OBSERVED MORTALITY										
	1960-70	8838743			9117717			16936756		
	1970-80	14662591			18795210			30919273		
	1980-90	22352391			28333384			46570955		
	1990-00	30378198			38274445			62961532		
ALL CAUSES COMBINED										
Fixed at:	1960-70	8824497	14246	0.02	9132600	14883	0.02	16937394	-637	0.00
1960	1970-80	14179953	482638	0.51	19280987	485777	0.51	30922411	-3138	0.00
	1980-90	20279210	2073181	2.01	30387456	2054072	1.99	46551846	19109	0.02
	1990-00	26107278	4270921	3.84	42434238	4159793	3.74	62850405	111128	0.10
1970	1970-80	5469491	354357	0.37	10030433	352940	0.37	13981099	1417	0.00
	1980-90	11653980	1859669	1.80	21058107	1842441	1.79	29616971	17228	0.02
	1990-00	17601269	3938187	3.54	33026496	3869769	3.48	45956358	68418	0.06
1980	1980-90	7454169	235631	0.23	9772737	234563	0.23	15650615	1067	0.00
	1990-00	13898343	1817265	1.63	21286633	1807399	1.63	32032394	9865	0.01
1990	1990-00	7831171	194637	0.18	10135740	194679	0.18	16390620	-43	0.00
INFECTIOUS & PARASITIC DISEASES										
Fixed at:	1960-70	8826669	12073	0.01	9129667	11949	0.01	16936632	124	0.00
1960	1970-80	14610144	52447	0.05	18846765	51554	0.05	30918379	893	0.00
	1980-90	22293673	58718	0.06	28389154	55770	0.05	46568007	2948	0.00
	1990-00	30486745	-108546	-0.10	38160887	-113557	-0.10	62956521	5011	0.00
1970	1970-80	5820691	3158	0.00	9680585	3092	0.00	13982451	65	0.00
	1980-90	13533115	-19466	-0.02	19195547	-20120	-0.02	29633546	653	0.00
	1990-00	21750038	-210583	-0.19	28945251	-211476	-0.19	46023882	894	0.00
1980	1980-90	7723257	-33457	-0.03	9504787	-33386	-0.03	15651754	-71	0.00
	1990-00	15952710	-237102	-0.21	19243721	-235513	-0.21	32043849	-1589	0.00
1990	1990-00	8037659	-11852	-0.01	9929462	-11598	-0.01	16390831	-254	0.00
Tuberculosis–all forms										
Fixed at:	1960-70	8829233	9510	0.01	9127165	9448	0.01	16936694	62	0.00
1960	1970-80	14615831	46760	0.05	18841514	46304	0.05	30918816	456	0.00
	1980-90	22265739	86652	0.08	28418707	85323	0.08	46569626	1329	0.00
	1990-00	30255213	122985	0.11	38394632	120187	0.11	62958734	2798	0.00
1970	1970-80	5818700	5148	0.01	9682635	5142	0.01	13982510	7	0.00
	1980-90	13493590	20058	0.02	19235645	19978	0.02	29634119	80	0.00
	1990-00	21504797	34658	0.03	29191160	34433	0.03	46024551	225	0.00
1980	1980-90	7688508	1292	0.00	9539467	1293	0.00	15651683	-1	0.00
	1990-00	15710280	5327	0.00	19484569	5335	0.00	32042267	-8	0.00
1990	1990-00	8024730	1077	0.00	9942135	1074	0.00	16390574	3	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HIV infection										
Fixed at:	1960-70	8838743	0	0.00	9117717	0	0.00	16936756	0	0.00
1960	1970-80	14662591	0	0.00	18795210	0	0.00	30919273	0	0.00
	1980-90	22367052	-14661	-0.01	28318771	-14613	-0.01	46571003	-48	0.00
	1990-00	30576329	-198131	-0.18	38077777	-196667	-0.18	62962996	-1463	0.00
1970	1970-80	5823848	0	0.00	9677493	0	0.00	13982516	0	0.00
	1980-90	13528310	-14661	-0.01	19201053	-14613	-0.01	29634247	-48	0.00
	1990-00	21737587	-198131	-0.18	28960060	-196667	-0.18	46026239	-1463	0.00
1980	1980-90	7704461	-14661	-0.01	9523560	-14613	-0.01	15651730	-48	0.00
	1990-00	15913738	-198131	-0.18	19282567	-196667	-0.18	32043723	-1463	0.00
1990	1990-00	8036793	-10986	-0.01	9930319	-10741	-0.01	16390821	-244	0.00
All other infectious & parasitic diseases										
Fixed at:	1960-70	8836179	2564	0.00	9120219	2502	0.00	16936694	62	0.00
1960	1970-80	14656899	5692	0.01	18800466	5255	0.01	30918836	437	0.00
	1980-90	22365765	-13374	-0.01	28318343	-15041	-0.01	46569288	1667	0.00
	1990-00	30411993	-33794	-0.03	38236974	-37470	-0.03	62957856	3676	0.00
1970	1970-80	5825840	-1992	0.00	9675442	-2050	0.00	13982458	59	0.00
	1980-90	13538547	-24898	-0.02	19190148	-25519	-0.02	29633578	621	0.00
	1990-00	21586633	-47177	-0.04	29107419	-49309	-0.04	46022644	2132	0.00
1980	1980-90	7709886	-20086	-0.02	9518110	-20064	-0.02	15651705	-22	0.00
	1990-00	15759831	-44224	-0.04	19435129	-44106	-0.04	32042378	-118	0.00
1990	1990-00	8027750	-1943	0.00	9939130	-1931	0.00	16390590	-13	0.00
CANCERS										
Fixed at:	1960-70	8864987	-26244	-0.03	9091416	-26302	-0.03	16936699	58	0.00
1960	1970-80	14804948	-142357	-0.15	18651516	-143694	-0.15	30917935	1337	0.00
	1980-90	22608493	-256102	-0.25	28069800	-263584	-0.26	46563473	7482	0.01
	1990-00	30638809	-260611	-0.23	37992630	-281814	-0.25	62940329	21204	0.02
1970	1970-80	5851077	-27228	-0.03	9650042	-27451	-0.03	13982294	223	0.00
	1980-90	13597686	-84038	-0.08	19128576	-87090	-0.08	29631147	3052	0.00
	1990-00	21586711	-47255	-0.04	29098973	-57754	-0.05	46014277	10499	0.01
1980	1980-90	7698941	-9140	-0.01	9528908	-9266	-0.01	15651558	125	0.00
	1990-00	15669000	46608	0.04	19524252	45018	0.04	32040670	1590	0.00
1990	1990-00	7989098	36709	0.03	9977659	36598	0.03	16390466	111	0.00
Cancer–buccal cavity, pharynx, esophagus, & larynx										
Fixed at:	1960-70	8837893	849	0.00	9118566	848	0.00	16936755	1	0.00
1960	1970-80	14662541	51	0.00	18795241	31	0.00	30919253	20	0.00
	1980-90	22345089	7302	0.01	28340597	7213	0.01	46570866	89	0.00
	1990-00	30361797	16401	0.01	38290629	16185	0.01	62961315	217	0.00
1970	1970-80	5823256	592	0.00	9678085	592	0.00	13982516	0	0.00
	1980-90	13504987	8661	0.01	19224313	8647	0.01	29634184	15	0.00
	1990-00	21522447	17009	0.02	29173684	16957	0.02	46024724	52	0.00
1980	1980-90	7687296	2504	0.00	9540678	2505	0.00	15651683	0	0.00
	1990-00	15709013	6594	0.01	19485830	6596	0.01	32042261	-2	0.00
1990	1990-00	8025835	-27	0.00	9941039	-22	0.00	16390582	-5	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cancer–trachea, bronchus, & lung										
Fixed at:	1960-70	8869208	-30466	-0.03	9087260	-30458	-0.03	16936764	-8	0.00
1960	1970-80	14827406	-164815	-0.17	18630463	-164747	-0.17	30919341	-68	0.00
	1980-90	22675982	-323591	-0.31	28009939	-323445	-0.31	46571101	-146	0.00
	1990-00	30789847	-411649	-0.37	37863045	-411400	-0.37	62961781	-249	0.00
1970	1970-80	5851428	-27580	-0.03	9649914	-27579	-0.03	13982517	-1	0.00
	1980-90	13623829	-110181	-0.11	19105452	-110215	-0.11	29634165	34	0.00
	1990-00	21674112	-134657	-0.12	29021929	-134798	-0.12	46024634	142	0.00
1980	1980-90	7699204	-9404	-0.01	9528763	-9410	-0.01	15651676	6	0.00
	1990-00	15702353	13255	0.01	19492434	13200	0.01	32042205	54	0.00
1990	1990-00	8003138	22669	0.02	9963728	22668	0.02	16390576	1	0.00
Cancer–other avoidable forms										
Fixed at:	1960-70	8838083	659	0.00	9118353	636	0.00	16936733	24	0.00
1960	1970-80	14640872	21719	0.02	18816119	20909	0.02	30918462	811	0.00
	1980-90	22279405	72987	0.07	28402087	68703	0.07	46566671	4284	0.00
	1990-00	30226559	151640	0.14	38413904	139460	0.13	62949352	12180	0.01
1970	1970-80	5822213	1635	0.00	9679014	1521	0.00	13982402	114	0.00
	1980-90	13477488	36160	0.04	19250186	34519	0.03	29632558	1641	0.00
	1990-00	21440240	99216	0.09	29249934	93207	0.08	46018767	6009	0.01
1980	1980-90	7685025	4775	0.00	9542874	4700	0.00	15651607	75	0.00
	1990-00	15674437	41171	0.04	19519313	40079	0.04	32041168	1092	0.00
1990	1990-00	8017450	8358	0.01	9949314	8253	0.01	16390472	105	0.00
Cancer–all other forms										
Fixed at:	1960-70	8836034	2709	0.00	9120385	2668	0.00	16936715	41	0.00
1960	1970-80	14661688	903	0.00	18795538	328	0.00	30918698	575	0.00
	1980-90	22363964	-11573	-0.01	28318556	-14828	-0.01	46567700	3256	0.00
	1990-00	30392383	-14184	-0.01	38251200	-23244	-0.02	62952472	9060	0.01
1970	1970-80	5825674	-1826	0.00	9675558	-1935	0.00	13982407	109	0.00
	1980-90	13531781	-18132	-0.02	19196172	-19495	-0.02	29632836	1363	0.00
	1990-00	21566760	-27304	-0.02	29125126	-31601	-0.03	46020479	4297	0.00
1980	1980-90	7696807	-7007	-0.01	9531123	-7051	-0.01	15651639	44	0.00
	1990-00	15729842	-14234	-0.01	19464555	-14680	-0.01	32041814	445	0.00
1990	1990-00	8020077	5730	0.01	9946781	5720	0.01	16390567	10	0.00
CIRCULATORY DISEASES										
Fixed at:	1960-70	8796655	42088	0.05	9159713	41996	0.05	16936664	92	0.00
1960	1970-80	14123185	539406	0.57	19333005	537795	0.56	30917661	1611	0.00
	1980-90	20514875	1837517	1.78	30163876	1830492	1.77	46563931	7024	0.01
	1990-00	26853348	3524850	3.17	41783236	3508791	3.16	62945473	16060	0.01
1970	1970-80	5561960	261888	0.27	9939163	261670	0.27	13982298	219	0.00
	1980-90	12093958	1419691	1.38	20632516	1416850	1.37	29631358	2841	0.00
	1990-00	18523590	3015866	2.71	32164206	3007479	2.71	46016390	8386	0.01
1980	1980-90	7449803	239997	0.23	9778082	239908	0.23	15651594	89	0.00
	1990-00	14383292	1332315	1.20	20810681	1331447	1.20	32041391	868	0.00
1990	1990-00	7867821	157986	0.14	10099110	158049	0.14	16390640	-63	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cerebrovascular disease										
Fixed at:	1960-70	8812365	26378	0.03	9144097	26379	0.03	16936757	-1	0.00
1960	1970-80	14512392	150199	0.16	18945345	150134	0.16	30919207	65	0.00
	1980-90	21874205	478186	0.46	28810467	477083	0.46	46569852	1104	0.00
	1990-00	29572680	805519	0.72	39076432	801988	0.72	62958001	3531	0.00
1970	1970-80	5763063	60786	0.06	9738198	60705	0.06	13982436	81	0.00
	1980-90	13161697	351951	0.34	19566453	350787	0.34	29633034	1165	0.00
	1990-00	20891304	648152	0.58	29801122	644395	0.58	46021019	3757	0.00
1980	1980-90	7637634	52166	0.05	9590290	52116	0.05	15651633	50	0.00
	1990-00	15520595	195012	0.18	19673745	194511	0.17	32041759	501	0.00
1990	1990-00	8020145	5662	0.01	9946702	5641	0.01	16390556	21	0.00
Rheumatic fever & chronic rheumatic heart disease										
Fixed at:	1960-70	8827909	10834	0.01	9128335	10617	0.01	16936540	216	0.00
1960	1970-80	14621594	40998	0.04	18834295	39085	0.04	30917360	1913	0.00
	1980-90	22242503	109888	0.11	28437460	104076	0.10	46565143	5812	0.01
	1990-00	30197149	181050	0.16	38443575	169131	0.15	62949613	11919	0.01
1970	1970-80	5817283	6565	0.01	9684007	6514	0.01	13982465	51	0.00
	1980-90	13463018	50630	0.05	19265643	49977	0.05	29633546	653	0.00
	1990-00	21444076	95380	0.09	29250203	93476	0.08	46022872	1904	0.00
1980	1980-90	7687006	2794	0.00	9540956	2783	0.00	15651671	12	0.00
	1990-00	15701945	13662	0.01	19492792	13557	0.01	32042155	105	0.00
1990	1990-00	8024094	1714	0.00	9942776	1715	0.00	16390579	-2	0.00
Ischemic heart disease										
Fixed at:	1960-70	8867789	-29046	-0.03	9088701	-29016	-0.03	16936786	-30	0.00
1960	1970-80	14624403	38188	0.04	18833495	38285	0.04	30919369	-97	0.00
	1980-90	21247073	1105318	1.07	29438422	1105038	1.07	46570675	280	0.00
	1990-00	27905429	2472769	2.22	40746150	2471705	2.22	62960468	1064	0.00
1970	1970-80	5635957	187891	0.20	9865326	187833	0.20	13982458	59	0.00
	1980-90	12236451	1277197	1.24	20492222	1276555	1.24	29633557	642	0.00
	1990-00	18889007	2650449	2.38	31805378	2648651	2.38	46022978	1798	0.00
1980	1980-90	7482606	207194	0.20	9745358	207185	0.20	15651673	9	0.00
	1990-00	14650620	1064987	0.96	20544097	1064863	0.96	32042136	124	0.00
1990	1990-00	7889721	136087	0.12	10077170	136109	0.12	16390600	-22	0.00
Hypertensive disease										
Fixed at:	1960-70	8810242	28501	0.03	9146200	28483	0.03	16936738	18	0.00
1960	1970-80	14477157	185434	0.19	18980476	185266	0.19	30919105	168	0.00
	1980-90	22078458	273933	0.27	28606768	273384	0.27	46570407	549	0.00
	1990-00	30018359	359840	0.32	38633102	358657	0.32	62960349	1183	0.00
1970	1970-80	5812986	10863	0.01	9688342	10849	0.01	13982502	14	0.00
	1980-90	13509904	3745	0.00	19219294	3628	0.00	29634082	117	0.00
	1990-00	21533602	5853	0.01	29162271	5544	0.00	46024467	309	0.00
1980	1980-90	7683649	6151	0.01	9544317	6144	0.01	15651675	7	0.00
	1990-00	15698922	16686	0.02	19495876	16642	0.02	32042216	44	0.00
1990	1990-00	8030716	-4908	0.00	9936159	-4902	0.00	16390584	-7	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Atherosclerosis										
Fixed at:	1960-70	8833612	5130	0.01	9122850	5132	0.01	16936758	-2	0.00
1960	1970-80	14616487	46104	0.05	18841317	46107	0.05	30919275	-3	0.00
	1980-90	22250897	101494	0.10	28434868	101484	0.10	46570945	10	0.00
	1990-00	30204132	174067	0.16	38448481	174037	0.16	62961502	30	0.00
1970	1970-80	5813869	9979	0.01	9687471	9979	0.01	13982516	1	0.00
	1980-90	13465431	48217	0.05	19263877	48210	0.05	29634192	7	0.00
	1990-00	21436056	103400	0.09	29260107	103379	0.09	46024755	21	0.00
1980	1980-90	7677943	11857	0.01	9550030	11856	0.01	15651682	1	0.00
	1990-00	15665927	49681	0.04	19528910	49675	0.04	32042255	5	0.00
1990	1990-00	8021316	4491	0.00	9945552	4492	0.00	16390577	0	0.00
Other circulatory diseases										
Fixed at:	1960-70	8838662	81	0.00	9117908	191	0.00	16936866	-109	0.00
1960	1970-80	14586360	76231	0.08	18871877	76666	0.08	30919708	-435	0.00
	1980-90	22514764	-162373	-0.16	28171740	-161644	-0.16	46571684	-729	0.00
	1990-00	30602237	-224038	-0.20	38052071	-222374	-0.20	62963197	-1665	0.00
1970	1970-80	5836980	-13132	-0.01	9664347	-13145	-0.01	13982503	13	0.00
	1980-90	13821912	-308264	-0.30	18907145	-308521	-0.30	29633941	257	0.00
	1990-00	21965474	-426018	-0.38	28730110	-426617	-0.38	46024177	599	0.00
1980	1980-90	7729644	-39843	-0.04	9498320	-39853	-0.04	15651673	10	0.00
	1990-00	15698068	17539	0.02	19496684	17449	0.02	32042170	90	0.00
1990	1990-00	8010682	15125	0.01	9956239	15179	0.01	16390630	-53	0.00
EXTERNAL CAUSES										
Fixed at:	1960-70	8866796	-28054	-0.03	9090972	-26746	-0.03	16938064	-1308	0.00
1960	1970-80	14774621	-112029	-0.12	18695241	-99969	-0.10	30931332	-12060	-0.01
	1980-90	22458691	-106300	-0.10	28259917	-73467	-0.07	46603788	-32832	-0.03
	1990-00	30376450	1748	0.00	38331788	57344	0.05	63017128	-55595	-0.05
1970	1970-80	5786858	36990	0.04	9714221	36728	0.04	13982255	261	0.00
	1980-90	13327024	186625	0.18	19400035	184368	0.18	29631943	2256	0.00
	1990-00	21103738	435718	0.39	29580994	424267	0.38	46013325	11451	0.01
1980	1980-90	7634200	55600	0.05	9593134	54960	0.05	15651043	640	0.00
	1990-00	15491739	223869	0.20	19696692	217457	0.20	32035848	6411	0.01
1990	1990-00	8011377	14430	0.01	9955272	14211	0.01	16390358	219	0.00
Motor vehicle accidents										
Fixed at:	1960-70	8863531	-24788	-0.03	9093850	-23867	-0.03	16937677	-920	0.00
1960	1970-80	14707560	-44969	-0.05	18757169	-38042	-0.04	30926200	-6927	-0.01
	1980-90	22384655	-32264	-0.03	28318753	-14631	-0.01	46588588	-17633	-0.02
	1990-00	30342938	35261	0.03	38341393	66948	0.06	62993219	-31687	-0.03
1970	1970-80	5787735	36114	0.04	9713081	35588	0.04	13981991	526	0.00
	1980-90	13400413	113235	0.11	19325833	110167	0.11	29631130	3069	0.00
	1990-00	21292701	246755	0.22	29395154	238426	0.21	46016448	8328	0.01
1980	1980-90	7660705	29095	0.03	9566984	28810	0.03	15651398	285	0.00
	1990-00	15594465	121142	0.11	19597807	118573	0.11	32039691	2569	0.00
1990	1990-00	8012826	12982	0.01	9953840	12779	0.01	16390375	202	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Suicide										
Fixed at:	1960-70	8838842	-99	0.00	9117854	137	0.00	16936992	-236	0.00
1960	1970-80	14679442	-16850	-0.02	18780588	-14622	-0.02	30921501	-2228	0.00
	1980-90	22402607	-50216	-0.05	28289274	-44110	-0.04	46577061	-6105	-0.01
	1990-00	30462765	-84566	-0.08	38200308	-74137	-0.07	62971962	-10429	-0.01
1970	1970-80	5831673	-7825	-0.01	9669735	-7758	-0.01	13982583	-66	0.00
	1980-90	13539108	-25460	-0.02	19190200	-25466	-0.02	29634193	6	0.00
	1990-00	21582980	-43524	-0.04	29111809	-44919	-0.04	46023381	1395	0.00
1980	1980-90	7696438	-6638	-0.01	9531393	-6781	-0.01	15651540	143	0.00
	1990-00	15729566	-13958	-0.01	19463914	-15320	-0.01	32040898	1362	0.00
1990	1990-00	8023473	2334	0.00	9943337	2276	0.00	16390519	58	0.00
Homicide & legal intervention										
Fixed at:	1960-70	8842233	-3491	0.00	9114302	-3416	0.00	16936831	-75	0.00
1960	1970-80	14703758	-41167	-0.04	18755194	-40017	-0.04	30920423	-1150	0.00
	1980-90	22445305	-92914	-0.09	28245294	-88090	-0.09	46575780	-4824	0.00
	1990-00	30514180	-135981	-0.12	38149130	-125315	-0.11	62972199	-10666	-0.01
1970	1970-80	5831509	-7661	-0.01	9669984	-7509	-0.01	13982668	-152	0.00
	1980-90	13539698	-26050	-0.03	19191333	-24334	-0.02	29635915	-1716	0.00
	1990-00	21575708	-36252	-0.03	29124910	-31817	-0.03	46029211	-4435	0.00
1980	1980-90	7679022	10778	0.01	9548911	10738	0.01	15651642	40	0.00
	1990-00	15684974	30634	0.03	19509438	30204	0.03	32041830	430	0.00
1990	1990-00	8020926	4881	0.00	9945878	4817	0.00	16390513	64	0.00
Other accidents & injuries										
Fixed at:	1960-70	8838417	326	0.00	9118120	403	0.00	16936833	-76	0.00
1960	1970-80	14671509	-8918	-0.01	18788044	-7167	-0.01	30921023	-1751	0.00
	1980-90	22282948	69443	0.07	28407083	73699	0.07	46575212	-4257	0.00
	1990-00	30190737	187461	0.17	38464696	190252	0.17	62964323	-2790	0.00
1970	1970-80	5807484	16364	0.02	9693903	16410	0.02	13982562	-46	0.00
	1980-90	13388628	125020	0.12	19339790	124123	0.12	29633302	897	0.00
	1990-00	21270198	269258	0.24	29419822	263094	0.24	46018612	6164	0.01
1980	1980-90	7667426	22374	0.02	9560376	22203	0.02	15651511	172	0.00
	1990-00	15629432	86176	0.08	19563359	84125	0.08	32040209	2051	0.00
1990	1990-00	8031575	-5768	-0.01	9935399	-5662	-0.01	16390683	-106	0.00
SMOKING & ALCOHOL-RELATED DISEASES										
Fixed at:	1960-70	8875481	-36739	-0.04	9081000	-36718	-0.04	16936777	-21	0.00
1960	1970-80	14867021	-204430	-0.21	18590901	-204309	-0.21	30919393	-120	0.00
	1980-90	22696020	-343629	-0.33	27989639	-343745	-0.33	46570839	116	0.00
	1990-00	30754954	-376755	-0.34	37896814	-377631	-0.34	62960657	875	0.00
1970	1970-80	5737054	86794	0.09	9758541	81048	0.08	13976770	5747	0.01
	1980-90	13112524	401124	0.39	19564794	349127	0.34	29582202	51997	0.05
	1990-00	20630673	908783	0.82	29929101	772373	0.69	45888366	136409	0.12
1980	1980-90	7683602	6198	0.01	9544341	6167	0.01	15651652	31	0.00
	1990-00	15640235	75373	0.07	19554302	75068	0.07	32041955	305	0.00
1990	1990-00	7998695	27113	0.02	9968161	27101	0.02	16390565	12	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chronic liver disease & cirrhosis										
Fixed at:	1960-70	8845862	-7119	-0.01	9110613	-7105	-0.01	16936770	-14	0.00
1960	1970-80	14702046	-39455	-0.04	18755828	-39383	-0.04	30919345	-72	0.00
	1980-90	22379291	-26899	-0.03	28306312	-27072	-0.03	46570783	173	0.00
	1990-00	30359750	18449	0.02	38291986	17541	0.02	62960625	907	0.00
1970	1970-80	5821260	2588	0.00	9680042	2549	0.00	13982478	39	0.00
	1980-90	13468953	44695	0.04	19259870	44204	0.04	29633707	492	0.00
	1990-00	21423958	115498	0.10	29270639	113912	0.10	46023189	1587	0.00
1980	1980-90	7676703	13097	0.01	9551246	13072	0.01	15651658	25	0.00
	1990-00	15660030	55577	0.05	19534560	55326	0.05	32042008	252	0.00
1990	1990-00	8021333	4475	0.00	9945520	4459	0.00	16390561	16	0.00
MEDICALLY AVOIDABLE CONDITIONS										
Fixed at:	1960-70	8733352	105391	0.12	9222273	104556	0.12	16935921	835	0.00
1960	1970-80	13961742	700849	0.73	19486247	691036	0.72	30909459	9813	0.01
	1980-90	20698643	1653749	1.60	29937627	1604243	1.56	46521450	49505	0.05
	1990-00	27649959	2728239	2.45	40845927	2571482	2.31	62804775	156757	0.14
1970	1970-80	5653022	170827	0.18	9847425	169932	0.18	13981622	894	0.00
	1980-90	12734679	778970	0.76	19983819	768153	0.74	29623382	10817	0.01
	1990-00	20038715	1500740	1.35	30611733	1455005	1.31	45979041	45735	0.04
1980	1980-90	7653168	36632	0.04	9574508	36334	0.04	15651384	298	0.00
	1990-00	15431797	283810	0.26	19759872	280638	0.25	32039087	3172	0.00
1990	1990-00	8000385	25422	0.02	9966375	25314	0.02	16390469	108	0.00
Diabetes mellitus										
Fixed at:	1960-70	8841413	-2670	0.00	9115032	-2686	0.00	16936741	15	0.00
1960	1970-80	14663729	-1138	0.00	18793836	-1375	0.00	30919035	237	0.00
	1980-90	22329130	23261	0.02	28355421	22037	0.02	46569731	1225	0.00
	1990-00	30375295	2904	0.00	38274398	-47	0.00	62958582	2951	0.00
1970	1970-80	5814508	9341	0.01	9686778	9285	0.01	13982460	56	0.00
	1980-90	13475439	38209	0.04	19253249	37583	0.04	29633573	626	0.00
	1990-00	21517219	22237	0.02	29177227	20500	0.02	46023039	1737	0.00
1980	1980-90	7688629	1171	0.00	9539335	1161	0.00	15651673	10	0.00
	1990-00	15751772	-36164	-0.03	19443017	-36217	-0.03	32042207	53	0.00
1990	1990-00	8039770	-13963	-0.01	9927097	-13964	-0.01	16390576	1	0.00
Other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	8836674	2069	0.00	9119747	2030	0.00	16936717	39	0.00
1960	1970-80	14651302	11289	0.01	18806006	10795	0.01	30918779	494	0.00
	1980-90	22321236	31155	0.03	28362271	28887	0.03	46568688	2268	0.00
	1990-00	30321533	56665	0.05	38324973	50528	0.05	62955395	6137	0.01
1970	1970-80	5821762	2087	0.00	9679533	2040	0.00	13982470	47	0.00
	1980-90	13499359	14290	0.01	19229365	13698	0.01	29633607	592	0.00
	1990-00	21508268	31187	0.03	29185833	29106	0.03	46022694	2082	0.00
1980	1980-90	7688630	1170	0.00	9539309	1135	0.00	15651647	35	0.00
	1990-00	15707877	7730	0.01	19486634	7400	0.01	32041929	331	0.00
1990	1990-00	8025103	705	0.00	9941746	685	0.00	16390557	20	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Pneumonia & influenza										
Fixed at:	1960-70	9052893	-214150	-0.24	8903511	-214206	-0.24	16936700	56	0.00
1960	1970-80	15038061	-375470	-0.39	18419193	-376017	-0.39	30918725	547	0.00
	1980-90	23103634	-751243	-0.73	27577751	-755633	-0.73	46566565	4390	0.00
	1990-00	31316579	-938381	-0.84	37319305	-955140	-0.86	62944773	16759	0.02
1970	1970-80	6123798	-299949	-0.31	9377428	-300065	-0.31	13982400	116	0.00
	1980-90	14258090	-744442	-0.72	18469570	-746097	-0.72	29632544	1655	0.00
	1990-00	22516107	-976651	-0.88	28172771	-983956	-0.89	46017471	7305	0.01
1980	1980-90	8382704	-692904	-0.67	8845243	-692930	-0.67	15651656	27	0.00
	1990-00	16810898	-1095290	-0.99	18383748	-1095486	-0.99	32042064	196	0.00
1990	1990-00	8453303	-427496	-0.38	9513561	-427499	-0.38	16390574	3	0.00
Other respiratory diseases										
Fixed at:	1960-70	8866477	-27734	-0.03	9089979	-27738	-0.03	16936752	4	0.00
1960	1970-80	14753459	-90867	-0.10	18704212	-90998	-0.10	30919142	131	0.00
	1980-90	22513013	-160622	-0.16	28171459	-161925	-0.16	46569652	1303	0.00
	1990-00	30571059	-192861	-0.17	38076729	-197716	-0.18	62956677	4855	0.00
1970	1970-80	5828024	-4176	0.00	9673258	-4235	0.00	13982457	59	0.00
	1980-90	13550000	-36352	-0.04	19178743	-36923	-0.04	29633627	572	0.00
	1990-00	21576589	-37133	-0.03	29117739	-38988	-0.04	46022920	1856	0.00
1980	1980-90	7708652	-18852	-0.02	9519315	-18858	-0.02	15651676	7	0.00
	1990-00	15730635	-15028	-0.01	19464240	-14994	-0.01	32042293	-34	0.00
1990	1990-00	8022497	3311	0.00	9944393	3333	0.00	16390599	-22	0.00
Other avoidable digestive & genitourinary diseases										
Fixed at:	1960-70	8819427	19316	0.02	9136931	19213	0.02	16936654	103	0.00
1960	1970-80	14520967	141624	0.15	18935207	139997	0.15	30917645	1627	0.00
	1980-90	22081213	271178	0.26	28598150	264766	0.26	46564544	6412	0.01
	1990-00	29965247	412951	0.37	38672651	398206	0.36	62946787	14745	0.01
1970	1970-80	5794997	28852	0.03	9706205	28712	0.03	13982377	139	0.00
	1980-90	13427319	86329	0.08	19300584	84918	0.08	29632788	1411	0.00
	1990-00	21377689	161767	0.15	29314366	157639	0.14	46020648	4128	0.00
1980	1980-90	7686333	3467	0.00	9541613	3439	0.00	15651655	28	0.00
	1990-00	15681486	34121	0.03	19513051	33816	0.03	32041955	305	0.00
1990	1990-00	8021339	4468	0.00	9945537	4476	0.00	16390585	-8	0.00
Certain causes of perinatal mortality										
Fixed at:	1960-70	8814100	24643	0.03	9142360	24643	0.03	16936756	0	0.00
1960	1970-80	14546456	116136	0.12	18911110	115900	0.12	30919037	236	0.00
	1980-90	22064167	288224	0.28	28612897	279513	0.27	46562244	8711	0.01
	1990-00	29842454	535744	0.48	38761169	486724	0.44	62912512	49020	0.04
1970	1970-80	5795789	28059	0.03	9705551	28058	0.03	13982515	1	0.00
	1980-90	13389565	124083	0.12	19339461	123794	0.12	29633910	289	0.00
	1990-00	21270268	269187	0.24	29416476	259749	0.23	46015338	9438	0.01
1980	1980-90	7677448	12352	0.01	9550527	12353	0.01	15651684	-1	0.00
	1990-00	15655608	60000	0.05	19539098	59863	0.05	32042123	136	0.00
1990	1990-00	8018295	7512	0.01	9948572	7512	0.01	16390577	1	0.00

(continued)

TABLE 3.4 Components of Population Change, 1960-2000, White Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
All other avoidable conditions										
Fixed at:	1960-70	8832402	6340	0.01	9123821	6104	0.01	16936520	237	0.00
1960	1970-80	14632941	29650	0.03	18822166	26956	0.03	30916578	2694	0.00
	1980-90	22288196	64195	0.06	28387209	53825	0.05	46560585	10370	0.01
	1990-00	30259651	118547	0.11	38366384	91939	0.08	62934924	26608	0.02
1970	1970-80	5820410	3439	0.00	9680780	3288	0.00	13982365	151	0.00
	1980-90	13499889	13759	0.01	19228027	12360	0.01	29632800	1399	0.00
	1990-00	21502353	37103	0.03	29188925	32198	0.03	46019871	4905	0.00
1980	1980-90	7687109	2691	0.00	9540793	2620	0.00	15651611	71	0.00
	1990-00	15700635	14972	0.01	19493636	14401	0.01	32041689	571	0.00
1990	1990-00	8023248	2559	0.00	9943614	2554	0.00	16390572	5	0.00
Other endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	8852753	-14010	-0.02	9103781	-13937	-0.02	16936830	-73	0.00
1960	1970-80	14715794	-53203	-0.06	18742942	-52268	-0.05	30920208	-935	0.00
	1980-90	22485556	-133165	-0.13	28204088	-129296	-0.13	46574823	-3868	0.00
	1990-00	30626075	-247877	-0.22	38036395	-238050	-0.21	62971359	-9827	-0.01
1970	1970-80	5824663	-814	0.00	9676665	-828	0.00	13982503	13	0.00
	1980-90	13551928	-38280	-0.04	19177263	-38403	-0.04	29634075	124	0.00
	1990-00	21643511	-104055	-0.09	29052224	-104504	-0.09	46024328	448	0.00
1980	1980-90	7705695	-15895	-0.02	9522231	-15942	-0.02	15651635	47	0.00
	1990-00	15783245	-67637	-0.06	19411231	-68003	-0.06	32041894	366	0.00
1990	1990-00	8039870	-14063	-0.01	9927041	-14020	-0.01	16390620	-43	0.00
Other digestive & genitourinary diseases										
Fixed at:	1960-70	8839441	-698	0.00	9116979	-739	0.00	16936715	41	0.00
1960	1970-80	14677712	-15121	-0.02	18779651	-15559	-0.02	30918834	438	0.00
	1980-90	22366692	-14301	-0.01	28315937	-17447	-0.02	46567809	3146	0.00
	1990-00	30373108	5090	0.00	38269176	-5269	0.00	62951173	10359	0.01
1970	1970-80	5824245	-397	0.00	9677021	-472	0.00	13982441	75	0.00
	1980-90	13507651	5998	0.01	19220690	5023	0.00	29633224	975	0.00
	1990-00	21514170	25285	0.02	29179152	22425	0.02	46021915	2861	0.00
1980	1980-90	7693395	-3595	0.00	9534559	-3614	0.00	15651663	19	0.00
	1990-00	15709962	5646	0.01	19484687	5452	0.00	32042066	193	0.00
1990	1990-00	8024335	1472	0.00	9942543	1483	0.00	16390588	-11	0.00
All other causes										
Fixed at:	1960-70	8844695	-5952	-0.01	9111827	-5891	-0.01	16936818	-62	0.00
1960	1970-80	14707754	-45162	-0.05	18750928	-44282	-0.05	30920153	-880	0.00
	1980-90	22427086	-74695	-0.07	28260784	-72600	-0.07	46573050	-2095	0.00
	1990-00	30472337	-94138	-0.08	38184867	-89578	-0.08	62966092	-4560	0.00
1970	1970-80	5834042	-10194	-0.01	9667345	-10148	-0.01	13982563	-46	0.00
	1980-90	13526712	-13063	-0.01	19202301	-13366	-0.01	29633896	303	0.00
	1990-00	21547752	-8296	-0.01	29147485	-9242	-0.01	46023830	946	0.00
1980	1980-90	7691363	-1562	0.00	9536595	-1578	0.00	15651667	16	0.00
	1990-00	15709995	5612	0.01	19484628	5394	0.00	32042041	218	0.00
1990	1990-00	8035676	-9869	-0.01	9931209	-9852	0.01	16390594	-17	0.00

TABLE 3.5 Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, Black Females

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OBSERVED MORTALITY										
	1960-70	2022710			804334			2827043		
	1970-80	3839963			1575605			5415567		
	1980-90	5955532			2348769			8304301		
	1990-00	8071304			3288131			11359435		
ALL CAUSES COMBINED										
Fixed at:	1960-70	2005044	17666	0.14	821839	17506	0.14	2826883	161	0.00
1960	1970-80	3662117	177846	1.27	1751341	175736	1.25	5413457	2110	0.02
	1980-90	5456106	499426	3.10	2827308	478538	2.97	8283413	20887	0.13
	1990-00	7151098	920207	5.04	4134998	846867	4.64	11286096	73339	0.40
1970	1970-80	1748565	68688	0.49	838867	67597	0.48	2587432	1091	0.01
	1980-90	3632776	300046	1.86	1832187	287752	1.78	5464963	12294	0.08
	1990-00	5426894	621701	3.41	3065625	581828	3.19	8492519	39873	0.22
1980	1980-90	2104323	11245	0.07	784154	10990	0.07	2888478	256	0.00
	1990-00	4129709	101632	0.56	1813325	100799	0.55	5943034	834	0.00
1990	1990-00	2108249	7524	0.04	946986	7624	0.04	3055234	-100	0.00
INFECTIOUS & PARASITIC DISEASES										
Fixed at:	1960-70	2020403	2307	0.02	806543	2210	0.02	2826946	97	0.00
1960	1970-80	3831013	8950	0.06	1583827	8223	0.06	5414840	727	0.01
	1980-90	5940132	15400	0.10	2361873	13104	0.08	8302005	2296	0.01
	1990-00	8077971	-6666	-0.04	3278299	-9832	-0.05	11356269	3166	0.02
1970	1970-80	1816529	724	0.01	771938	667	0.00	2588467	57	0.00
	1980-90	3932660	162	0.00	1544120	-315	0.00	5476780	477	0.00
	1990-00	6077989	-29394	-0.16	2454304	-29493	-0.16	8532293	99	0.00
1980	1980-90	2120150	-4581	-0.03	768670	-4494	-0.03	2888820	-87	0.00
	1990-00	4271611	-40269	-0.22	1674105	-38421	-0.21	5945716	-1848	-0.01
1990	1990-00	2126479	-10706	-0.06	928922	-10439	-0.06	3055401	-267	0.00
Tuberculosis–all forms										
Fixed at:	1960-70	2021248	1461	0.01	805715	1381	0.01	2826963	80	0.00
1960	1970-80	3831725	8237	0.06	1583234	7629	0.05	5414959	608	0.00
	1980-90	5936998	18533	0.11	2365502	16733	0.10	8302500	1801	0.01
	1990-00	8040484	30820	0.17	3315254	27123	0.15	11355739	3697	0.02
1970	1970-80	1816294	959	0.01	772208	937	0.01	2588502	22	0.00
	1980-90	3928561	4261	0.03	1548493	4058	0.03	5477054	203	0.00
	1990-00	6040054	8541	0.05	2491826	8029	0.04	8531879	512	0.00
1980	1980-90	2115355	214	0.00	773380	216	0.00	2888736	-2	0.00
	1990-00	4230319	1022	0.01	1713582	1056	0.01	5943902	-34	0.00
1990	1990-00	2115297	476	0.00	939827	465	0.00	3055123	11	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HIV infection										
Fixed at:	1960-70	2022710	0	0.00	804334	0	0.00	2827043	0	0.00
1960	1970-80	3839963	0	0.00	1575605	0	0.00	5415567	0	0.00
	1980-90	5956799	-1268	-0.01	2347556	-1213	-0.01	8304356	-55	0.00
	1990-00	8102825	-31520	-0.17	3258263	-29867	-0.16	11361088	-1653	-0.01
1970	1970-80	1817253	0	0.00	771271	0	0.00	2588524	0	0.00
	1980-90	3934090	-1268	-0.01	1543222	-1213	-0.01	5477312	-55	0.00
	1990-00	6080115	-31520	-0.17	2453930	-29867	-0.16	8534045	-1653	-0.01
1980	1980-90	2116837	-1268	-0.01	771952	-1213	-0.01	2888788	-55	0.00
	1990-00	4262862	-31520	-0.17	1682659	-29867	-0.16	5945521	-1653	-0.01
1990	1990-00	2126621	-10848	-0.06	928802	-10560	-0.06	3055423	-288	0.00
All other infectious & parasitic diseases										
Fixed at:	1960-70	2021864	845	0.01	805162	828	0.01	2827026	17	0.00
1960	1970-80	3839250	713	0.01	1576198	594	0.00	5415448	119	0.00
	1980-90	5957414	-1882	-0.01	2346337	-2432	-0.02	8303751	550	0.00
	1990-00	8077388	-6083	-0.03	3280927	-7204	-0.04	11358315	1121	0.01
1970	1970-80	1817488	-235	0.00	771001	-270	0.00	2588489	35	0.00
	1980-90	3935659	-2837	-0.02	1541269	-3166	-0.02	5476928	329	0.00
	1990-00	6055046	-6451	-0.04	2476107	-7690	-0.04	8531153	1239	0.01
1980	1980-90	2119096	-3527	-0.02	769667	-3497	-0.02	2888763	-29	0.00
	1990-00	4241105	-9763	-0.05	1702924	-9602	-0.05	5944029	-161	0.00
1990	1990-00	2116107	-334	0.00	939017	-344	0.00	3055124	10	0.00
CANCERS										
Fixed at:	1960-70	2022605	105	0.00	804406	72	0.00	2827011	32	0.00
1960	1970-80	3841684	-1721	-0.01	1573434	-2170	-0.02	5415118	449	0.00
	1980-90	5967532	-12001	-0.07	2334904	-13865	-0.09	8302437	1864	0.01
	1990-00	8086814	-15510	-0.09	3268029	-20102	-0.11	11354843	4592	0.03
1970	1970-80	1818702	-1449	-0.01	769754	-1517	-0.01	2588456	68	0.00
	1980-90	3947024	-14202	-0.09	1529605	-14831	-0.09	5476629	628	0.00
	1990-00	6070931	-22336	-0.12	2459536	-24261	-0.13	8530468	1924	0.01
1980	1980-90	2119566	-3997	-0.02	769138	-4026	-0.03	2888704	29	0.00
	1990-00	4240587	-9245	-0.05	1702965	-9561	-0.05	5943552	316	0.00
1990	1990-00	2114915	857	0.00	940208	846	0.00	3055123	11	0.00
Cancer–buccal cavity, pharynx, esophagus, & larynx										
Fixed at:	1960-70	2023019	-309	0.00	804028	-306	0.00	2827047	-4	0.00
1960	1970-80	3842001	-2039	-0.01	1573575	-2030	-0.01	5415577	-9	0.00
	1980-90	5960217	-4685	-0.03	2344082	-4687	-0.03	8304299	1	0.00
	1990-00	8076820	-5516	-0.03	3282585	-5545	-0.03	11359405	30	0.00
1970	1970-80	1817839	-586	0.00	770683	-588	0.00	2588522	2	0.00
	1980-90	3935050	-2228	-0.01	1542191	-2244	-0.01	5477241	16	0.00
	1990-00	6050645	-2050	-0.01	2481697	-2100	-0.01	8532342	50	0.00
1980	1980-90	2115456	113	0.00	773276	111	0.00	2888732	2	0.00
	1990-00	4229630	1712	0.01	1714220	1694	0.01	5943850	18	0.00
1990	1990-00	2115131	641	0.00	940001	640	0.00	3055133	2	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cancer–trachea, bronchus, & lung										
Fixed at:	1960-70	2023571	-861	-0.01	803479	-855	-0.01	2827050	-7	0.00
1960	1970-80	3848093	-8130	-0.06	1567500	-8105	-0.06	5415592	-25	0.00
	1980-90	5981479	-25947	-0.16	2322854	-25915	-0.16	8304333	-32	0.00
	1990-00	8123244	-51940	-0.28	3236245	-51886	-0.28	11359489	-54	0.00
1970	1970-80	1819237	-1984	-0.01	769285	-1986	-0.01	2588522	2	0.00
	1980-90	3947861	-15039	-0.09	1529378	-15058	-0.09	5477239	19	0.00
	1990-00	6084700	-36105	-0.20	2447645	-36152	-0.20	8532346	46	0.00
1980	1980-90	2118578	-3009	-0.02	770156	-3008	-0.02	2888734	-0	0.00
	1990-00	4246719	-15377	-0.08	1697153	-15373	-0.08	5943872	-4	0.00
1990	1990-00	2117058	-1285	-0.01	938074	-1288	-0.01	3055132	3	0.00
Cancer–other avoidable forms										
Fixed at:	1960-70	2021704	1006	0.01	805311	977	0.01	2827015	28	0.00
1960	1970-80	3830465	9497	0.07	1584815	9211	0.07	5415281	287	0.00
	1980-90	5933469	22062	0.14	2369801	21032	0.13	8303271	1030	0.01
	1990-00	8030052	41252	0.23	3326945	38814	0.21	11356997	2438	0.01
1970	1970-80	1815649	1604	0.01	772840	1569	0.01	2588490	34	0.00
	1980-90	3926357	6465	0.04	1550595	6160	0.04	5476952	305	0.00
	1990-00	6031857	16738	0.09	2499614	15817	0.09	8531470	921	0.01
1980	1980-90	2116320	-751	0.00	772405	-759	0.00	2888725	8	0.00
	1990-00	4229077	2265	0.01	1714662	2136	0.01	5943739	129	0.00
1990	1990-00	2114132	1641	0.01	940992	1631	0.01	3055124	10	0.00
Cancer–all other forms										
Fixed at:	1960-70	2022439	270	0.00	804590	256	0.00	2827029	14	0.00
1960	1970-80	3840991	-1028	-0.01	1574380	-1225	-0.01	5415371	196	0.00
	1980-90	5958753	-3221	-0.02	2344682	-4087	-0.03	8303435	866	0.01
	1990-00	8069898	1406	0.01	3287358	-773	0.00	11357256	2179	0.01
1970	1970-80	1817732	-479	0.00	770762	-509	0.00	2588494	30	0.00
	1980-90	3936098	-3276	-0.02	1540871	-3565	-0.02	5476969	288	0.00
	1990-00	6049009	-414	0.00	2482476	-1321	-0.01	8531485	907	0.00
1980	1980-90	2115910	-341	0.00	772804	-361	0.00	2888714	20	0.00
	1990-00	4229122	2220	0.01	1714573	2047	0.01	5943695	173	0.00
1990	1990-00	2115908	-135	0.00	939229	-132	0.00	3055138	-3	0.00
CIRCULATORY DISEASES										
Fixed at:	1960-70	2009412	13298	0.11	817585	13251	0.11	2826997	46	0.00
1960	1970-80	3718005	121958	0.87	1696512	120908	0.86	5414517	1050	0.01
	1980-90	5640614	314918	1.95	2659015	310246	1.92	8299629	4672	0.03
	1990-00	7508412	562892	3.09	3840257	552126	3.03	11348669	10766	0.06
1970	1970-80	1776456	40797	0.29	811834	40563	0.29	2588290	234	0.00
	1980-90	3752054	180768	1.12	1722953	178518	1.11	5475007	2250	0.01
	1990-00	5661380	387215	2.12	2864904	381107	2.09	8526284	6108	0.03
1980	1980-90	2099711	15858	0.10	788971	15807	0.10	2888683	51	0.00
	1990-00	4110464	120878	0.66	1832926	120400	0.66	5943390	477	0.00
1990	1990-00	2102991	12782	0.07	952152	12791	0.07	3055143	-9	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cerebrovascular disease										
Fixed at:	1960-70	2016599	6110	0.05	810439	6105	0.05	2827038	5	0.00
1960	1970-80	3789485	50478	0.36	1625900	50295	0.36	5415385	183	0.00
	1980-90	5819385	136146	0.84	2483923	135154	0.84	8303309	992	0.01
	1990-00	7837504	233800	1.28	3519399	231269	1.27	11356904	2531	0.01
1970	1970-80	1801957	15296	0.11	786502	15231	0.11	2588459	65	0.00
	1980-90	3854752	78070	0.48	1621876	77441	0.48	5476629	628	0.00
	1990-00	5892025	156569	0.86	2638541	154744	0.85	8530567	1825	0.01
1980	1980-90	2105934	9635	0.06	782779	9615	0.06	2888713	20	0.00
	1990-00	4187462	43880	0.24	1756189	43663	0.24	5943651	217	0.00
1990	1990-00	2113669	2104	0.01	941444	2082	0.01	3055113	21	0.00
Rheumatic fever & chronic rheumatic heart disease										
Fixed at:	1960-70	2021945	764	0.01	805057	723	0.01	2827002	41	0.00
1960	1970-80	3835098	4865	0.03	1579942	4337	0.03	5415040	527	0.00
	1980-90	5941276	14255	0.09	2361129	12360	0.08	8302405	1895	0.01
	1990-00	8045262	26043	0.14	3310029	21898	0.12	11355290	4145	0.02
1970	1970-80	1816335	918	0.01	772153	882	0.01	2588488	36	0.00
	1980-90	3926645	6177	0.04	1550211	5775	0.04	5476855	402	0.00
	1990-00	6035567	13028	0.07	2495677	11880	0.07	8531244	1148	0.01
1980	1980-90	2115267	302	0.00	773465	301	0.00	2888732	1	0.00
	1990-00	4229521	1821	0.01	1714299	1773	0.01	5943819	48	0.00
1990	1990-00	2115417	356	0.00	939714	352	0.00	3055131	4	0.00
Ischemic heart disease										
Fixed at:	1960-70	2027930	-5220	-0.04	799114	-5220	-0.04	2827043	0	0.00
1960	1970-80	3892201	-52238	-0.37	1523352	-52253	-0.37	5415552	15	0.00
	1980-90	5933273	22258	0.14	2370602	21833	0.14	8303875	425	0.00
	1990-00	7951123	120182	0.66	3407091	118960	0.65	11358214	1221	0.01
1970	1970-80	1797847	19406	0.14	790623	19352	0.14	2588471	53	0.00
	1980-90	3793722	139100	0.86	1682987	138551	0.86	5476709	548	0.00
	1990-00	5775190	273405	1.50	2755692	271895	1.49	8530883	1509	0.01
1980	1980-90	2105323	10246	0.06	783399	10235	0.06	2888722	11	0.00
	1990-00	4170777	60564	0.33	1772993	60467	0.33	5943770	98	0.00
1990	1990-00	2108512	7261	0.04	946620	7259	0.04	3055132	3	0.00
Hypertensive disease										
Fixed at:	1960-70	2012083	10627	0.09	814920	10586	0.09	2827003	41	0.00
1960	1970-80	3748718	91244	0.65	1666417	90812	0.65	5415135	432	0.00
	1980-90	5807682	147850	0.92	2495296	146526	0.91	8302977	1323	0.01
	1990-00	7863163	208142	1.14	3493464	205333	1.13	11356627	2808	0.02
1970	1970-80	1812582	4671	0.03	775908	4637	0.03	2588490	34	0.00
	1980-90	3934671	-1849	-0.01	1542360	-2075	-0.01	5477031	227	0.00
	1990-00	6050464	-1869	-0.01	2481367	-2430	-0.01	8531831	561	0.00
1980	1980-90	2113587	1982	0.01	775131	1966	0.01	2888718	15	0.00
	1990-00	4224387	6955	0.04	1719404	6878	0.04	5943791	77	0.00
1990	1990-00	2116368	-595	0.00	938772	-590	0.00	3055140	-6	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Atherosclerosis										
Fixed at:	1960-70	2022208	502	0.00	804835	501	0.00	2827042	1	0.00
1960	1970-80	3832785	7177	0.05	1582777	7172	0.05	5415562	5	0.00
	1980-90	5939529	16002	0.10	2364755	15986	0.10	8304284	16	0.00
	1990-00	8043075	28229	0.15	3316324	28193	0.15	11359399	36	0.00
1970	1970-80	1815785	1468	0.01	772738	1467	0.01	2588523	1	0.00
	1980-90	3926305	6517	0.04	1550946	6510	0.04	5477251	6	0.00
	1990-00	6033328	15267	0.08	2499049	15252	0.08	8532377	15	0.00
1980	1980-90	2113795	1774	0.01	774939	1775	0.01	2888733	0	0.00
	1990-00	4223293	8049	0.04	1720575	8049	0.04	5943868	0	0.00
1990	1990-00	2115157	616	0.00	939977	616	0.00	3055135	0	0.00
Other circulatory diseases										
Fixed at:	1960-70	2022210	500	0.00	804876	542	0.00	2827085	-42	0.00
1960	1970-80	3821259	18704	0.13	1594421	18816	0.13	5415680	-112	0.00
	1980-90	5969897	-14366	-0.09	2334380	-14389	-0.09	8304277	23	0.00
	1990-00	8092615	-21311	-0.12	3266781	-21349	-0.12	11359396	39	0.00
1970	1970-80	1818075	-822	-0.01	770403	-867	-0.01	2588478	46	0.00
	1980-90	3982220	-49398	-0.31	1494597	-49838	-0.31	5476817	440	0.00
	1990-00	6118835	-70240	-0.39	2412501	-71296	-0.39	8531335	1056	0.01
1980	1980-90	2123637	-8068	-0.05	765093	-8072	-0.05	2888730	3	0.00
	1990-00	4230020	1321	0.01	1713810	1284	0.01	5943830	38	0.00
1990	1990-00	2112657	3116	0.02	942508	3147	0.02	3055165	-31	0.00
EXTERNAL CAUSES										
Fixed at:	1960-70	2024606	-1896	-0.02	802628	-1706	-0.01	2827234	-190	0.00
1960	1970-80	3849325	-9363	-0.07	1568608	-6997	-0.05	5417933	-2366	-0.02
	1980-90	5953586	1946	0.01	2354890	6120	0.04	8308475	-4175	-0.03
	1990-00	8048808	22497	0.12	3314033	25902	0.14	11362841	-3406	-0.02
1970	1970-80	1811480	5773	0.04	776796	5525	0.04	2588275	249	0.00
	1980-90	3897941	34881	0.22	1575871	31435	0.19	5473812	3445	0.02
	1990-00	5973368	75227	0.41	2548289	64492	0.35	8521656	10735	0.06
1980	1980-90	2111350	4219	0.03	777212	4048	0.03	2888562	172	0.00
	1990-00	4217154	14188	0.08	1725855	13329	0.07	5943009	859	0.00
1990	1990-00	2113715	2057	0.01	941333	1971	0.01	3055048	86	0.00
Motor vehicle accidents										
Fixed at:	1960-70	2024439	-1730	-0.01	802732	-1601	-0.01	2827172	-128	0.00
1960	1970-80	3844308	-4345	-0.03	1572069	-3536	-0.03	5416377	-809	-0.01
	1980-90	5957943	-2411	-0.02	2347670	-1099	-0.01	8305613	-1312	-0.01
	1990-00	8072920	-1615	-0.01	3288492	361	0.00	11361412	-1976	-0.01
1970	1970-80	1814323	2930	0.02	774035	2764	0.02	2588358	166	0.00
	1980-90	3920996	11826	0.07	1554767	10332	0.06	5475763	1494	0.01
	1990-00	6027534	21061	0.12	2501032	17235	0.09	8528566	3825	0.02
1980	1980-90	2115670	-101	0.00	773082	-83	0.00	2888751	-18	0.00
	1990-00	4232952	-1610	-0.01	1711167	-1359	-0.01	5944118	-251	0.00
1990	1990-00	2116150	-377	0.00	939033	-328	0.00	3055183	-49	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Suicide										
Fixed at:	1960-70	2022973	-263	0.00	804101	-232	0.00	2827074	-30	0.00
1960	1970-80	3841802	-1840	-0.01	1574099	-1506	-0.01	5415901	-333	0.00
	1980-90	5958318	-2787	-0.02	2346721	-2048	-0.01	8305039	-739	0.00
	1990-00	8074518	-3213	-0.02	3286057	-2074	-0.01	11360574	-1139	-0.01
1970	1970-80	1817139	114	0.00	771364	93	0.00	2588503	21	0.00
	1980-90	3931341	1481	0.01	1545615	1180	0.01	5476957	300	0.00
	1990-00	6044895	3700	0.02	2486608	2811	0.02	8531504	888	0.00
1980	1980-90	2115294	275	0.00	773418	254	0.00	2888712	21	0.00
	1990-00	4230156	1186	0.01	1713582	1056	0.01	5943738	130	0.00
1990	1990-00	2115637	136	0.00	939497	135	0.00	3055134	0	0.00
Homicide & legal intervention										
Fixed at:	1960-70	2023513	-803	-0.01	803583	-751	-0.01	2827096	-52	0.00
1960	1970-80	3847122	-7159	-0.05	1569325	-6279	-0.04	5416447	-879	-0.01
	1980-90	5965749	-10218	-0.06	2341068	-7701	-0.05	8306818	-2517	-0.02
	1990-00	8084103	-12798	-0.07	3280191	-7940	-0.04	11364294	-4859	-0.03
1970	1970-80	1817318	-65	0.00	771228	-43	0.00	2588546	-22	0.00
	1980-90	3927968	4854	0.03	1549056	4621	0.03	5477024	233	0.00
	1990-00	6037018	11576	0.06	2494583	10786	0.06	8531601	791	0.00
1980	1980-90	2113964	1605	0.01	774673	1509	0.01	2888637	96	0.00
	1990-00	4227441	3901	0.02	1716166	3640	0.02	5943607	261	0.00
1990	1990-00	2113883	1890	0.01	941134	1773	0.01	3055017	117	0.00
Other accidents & injuries										
Fixed at:	1960-70	2021810	900	0.01	805213	879	0.01	2827023	21	0.00
1960	1970-80	3835979	3983	0.03	1579931	4326	0.03	5415910	-343	0.00
	1980-90	5938185	17347	0.11	2365722	16953	0.11	8303906	394	0.00
	1990-00	8031229	40076	0.22	3323641	35510	0.19	11354870	4565	0.03
1970	1970-80	1814458	2795	0.02	773983	2712	0.02	2588441	83	0.00
	1980-90	3916078	16744	0.10	1559760	15325	0.10	5475838	1419	0.01
	1990-00	6009609	38986	0.21	2517544	33747	0.19	8527153	5238	0.03
1980	1980-90	2113128	2441	0.02	775533	2368	0.01	2888661	73	0.00
	1990-00	4220630	10712	0.06	1722520	9994	0.05	5943149	718	0.00
1990	1990-00	2115364	408	0.00	939753	391	0.00	3055117	17	0.00
SMOKING & ALCOHOL-RELATED DISEASES										
Fixed at:	1960-70	2025795	-3085	-0.03	801301	-3033	-0.02	2827096	-52	0.00
1960	1970-80	3859686	-19724	-0.14	1556131	-19474	-0.14	5415817	-249	0.00
	1980-90	5997376	-41845	-0.26	2307168	-41601	-0.26	8304544	-243	0.00
	1990-00	8133304	-62000	-0.34	3226007	-62124	-0.34	11359311	124	0.00
1970	1970-80	1799340	17913	0.13	787603	16332	0.12	2586943	1580	0.01
	1980-90	3870236	62585	0.39	1593336	48901	0.30	5463573	13685	0.08
	1990-00	5926070	122524	0.67	2569246	85449	0.47	8495316	37075	0.20
1980	1980-90	2116120	-551	0.00	772578	-587	0.00	2888698	36	0.00
	1990-00	4232274	-932	-0.01	1711191	-1335	-0.01	5943465	403	0.00
1990	1990-00	2114297	1476	0.01	940806	1444	0.01	3055102	32	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chronic liver disease & cirrhosis										
Fixed at:	1960-70	2024623	-1914	-0.02	802462	-1872	-0.02	2827086	-42	0.00
1960	1970-80	3849491	-9529	-0.07	1566292	-9313	-0.07	5415783	-216	0.00
	1980-90	5966590	-11058	-0.07	2337923	-10846	-0.07	8304513	-212	0.00
	1990-00	8075477	-4173	-0.02	3283810	-4321	-0.02	11359287	148	0.00
1970	1970-80	1816806	447	0.00	771686	415	0.00	2588493	31	0.00
	1980-90	3925022	7800	0.05	1551845	7410	0.05	5476867	390	0.00
	1990-00	6023294	25301	0.14	2507742	23945	0.13	8531036	1355	0.01
1980	1980-90	2113224	2345	0.01	775475	2311	0.01	2888699	34	0.00
	1990-00	4218606	12736	0.07	1724873	12347	0.07	5943478	389	0.00
1990	1990-00	2113653	2120	0.01	941454	2092	0.01	3055107	28	0.00
MEDICALLY AVOIDABLE CONDITIONS										
Fixed at:	1960-70	1995060	27650	0.23	831527	27194	0.22	2826587	456	0.00
1960	1970-80	3603553	236409	1.69	1806826	231222	1.65	5410380	5188	0.04
	1980-90	5440092	515440	3.20	2840518	491749	3.05	8280610	23691	0.15
	1990-00	7223798	847506	4.65	4064743	776612	4.26	11288541	70894	0.39
1970	1970-80	1772051	45202	0.32	815877	44606	0.32	2587928	596	0.00
	1980-90	3762457	170365	1.06	1709069	164634	1.02	5471526	5731	0.04
	1990-00	5710693	337902	1.85	2799548	315751	1.73	8510241	22151	0.12
1980	1980-90	2109648	5921	0.04	779021	5857	0.04	2888670	64	0.00
	1990-00	4189291	42051	0.23	1753898	41372	0.23	5943188	679	0.00
1990	1990-00	2111321	4452	0.02	943740	4379	0.02	3055062	73	0.00
Diabetes mellitus										
Fixed at:	1960-70	2024063	-1353	-0.01	802971	-1363	-0.01	2827034	10	0.00
1960	1970-80	3843852	-3889	-0.03	1571613	-3991	-0.03	5415465	103	0.00
	1980-90	5952711	2821	0.02	2351160	2390	0.01	8303870	430	0.00
	1990-00	8071099	205	0.00	3287374	-757	0.00	11358473	963	0.01
1970	1970-80	1814432	2821	0.02	774073	2802	0.02	2588505	19	0.00
	1980-90	3919318	13504	0.08	1557744	13309	0.08	5477062	195	0.00
	1990-00	6034185	14410	0.08	2497703	13907	0.08	8531888	503	0.00
1980	1980-90	2115558	11	0.00	773167	3	0.00	2888725	8	0.00
	1990-00	4240224	-8882	-0.05	1703627	-8899	-0.05	5943851	17	0.00
1990	1990-00	2119022	-3249	-0.02	936114	-3248	-0.02	3055136	-2	0.00
Other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	2022578	132	0.00	804441	107	0.00	2827019	24	0.00
1960	1970-80	3837323	2640	0.02	1577973	2368	0.02	5415296	272	0.00
	1980-90	5945425	10107	0.06	2357622	8853	0.05	8303047	1254	0.01
	1990-00	8051667	19638	0.11	3304379	16248	0.09	11356046	3389	0.02
1970	1970-80	1816213	1040	0.01	772253	982	0.01	2588466	58	0.00
	1980-90	3926142	6680	0.04	1550538	6103	0.04	5476680	577	0.00
	1990-00	6034650	13945	0.08	2495983	12186	0.07	8530634	1758	0.01
1980	1980-90	2115140	429	0.00	773577	413	0.00	2888717	16	0.00
	1990-00	4229705	1637	0.01	1714070	1544	0.01	5943774	94	0.00
1990	1990-00	2115580	193	0.00	939563	202	0.00	3055143	-9	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Pneumonia & influenza										
Fixed at:	1960-70	2019947	2763	0.02	807065	2731	0.02	2827011	32	0.00
1960	1970-80	3817439	22523	0.16	1597734	22129	0.16	5415173	394	0.00
	1980-90	5897664	57867	0.36	2403506	54737	0.34	8301170	3131	0.02
	1990-00	7971784	99520	0.55	3374843	86712	0.48	11346628	12808	0.07
1970	1970-80	1810622	6631	0.05	777844	6573	0.05	2588465	59	0.00
	1980-90	3905609	27213	0.17	1570850	26415	0.16	5476460	798	0.00
	1990-00	5999005	49590	0.27	2528944	45147	0.25	8527949	4443	0.02
1980	1980-90	2116877	-1308	-0.01	771855	-1309	-0.01	2888732	1	0.00
	1990-00	4235501	-4159	-0.02	1708346	-4180	-0.02	5943847	20	0.00
1990	1990-00	2115464	309	0.00	939656	294	0.00	3055120	14	0.00
Other respiratory diseases										
Fixed at:	1960-70	2022842	-132	0.00	804187	-147	0.00	2827029	14	0.00
1960	1970-80	3839088	874	0.01	1576339	735	0.01	5415428	140	0.00
	1980-90	5958171	-2639	-0.02	2345416	-3353	-0.02	8303587	714	0.00
	1990-00	8081495	-10190	-0.06	3275496	-12635	-0.07	11356991	2444	0.01
1970	1970-80	1816062	1191	0.01	772424	1154	0.01	2588486	38	0.00
	1980-90	3935512	-2690	-0.02	1541415	-3020	-0.02	5476927	330	0.00
	1990-00	6060009	-11414	-0.06	2471223	-12573	-0.07	8531232	1159	0.01
1980	1980-90	2118606	-3037	-0.02	770135	-3029	-0.02	2888741	-7	0.00
	1990-00	4244254	-12912	-0.07	1699694	-12832	-0.07	5943948	-80	0.00
1990	1990-00	2117740	-1967	-0.01	937401	-1961	-0.01	3055141	-7	0.00
Other avoidable digestive & genitourinary diseases										
Fixed at:	1960-70	2021138	1572	0.01	805872	1538	0.01	2827010	33	0.00
1960	1970-80	3822255	17708	0.13	1592737	17133	0.12	5414992	575	0.00
	1980-90	5916905	38626	0.24	2385100	36331	0.23	8302005	2296	0.01
	1990-00	8003197	68107	0.37	3350975	62845	0.34	11354173	5263	0.03
1970	1970-80	1813122	4131	0.03	775318	4047	0.03	2588440	84	0.00
	1980-90	3919920	12902	0.08	1556598	12163	0.08	5476518	740	0.00
	1990-00	6019645	28950	0.16	2510726	26929	0.15	8530371	2021	0.01
1980	1980-90	2115680	-111	0.00	773035	-129	0.00	2888715	19	0.00
	1990-00	4226183	5159	0.03	1717540	5014	0.03	5943723	144	0.00
1990	1990-00	2114994	779	0.00	940126	764	0.00	3055120	15	0.00
Certain causes of perinatal mortality										
Fixed at:	1960-70	2020080	2630	0.02	806964	2630	0.02	2827043	0	0.00
1960	1970-80	3816656	23307	0.17	1598814	23209	0.17	5415470	97	0.00
	1980-90	5895534	59998	0.37	2405354	56585	0.35	8300888	3413	0.02
	1990-00	7952875	118430	0.65	3387842	99711	0.55	11340716	18719	0.10
1970	1970-80	1812704	4549	0.03	775821	4550	0.03	2588524	-1	0.00
	1980-90	3912173	20649	0.13	1564910	20475	0.13	5477083	174	0.00
	1990-00	5999706	48888	0.27	2528882	45085	0.25	8528588	3804	0.02
1980	1980-90	2113308	2260	0.01	775425	2261	0.01	2888734	0	0.00
	1990-00	4219095	12246	0.07	1724708	12182	0.07	5943804	64	0.00
1990	1990-00	2112103	3670	0.02	943031	3669	0.02	3055134	0	0.00

(continued)

TABLE 3.5 Components of Population Change, 1960-2000, Black Females (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
All other avoidable conditions										
Fixed at:	1960-70	2021433	1277	0.01	805481	1147	0.01	2826914	130	0.00
1960	1970-80	3828618	11344	0.08	1585491	9886	0.07	5414109	1458	0.01
	1980-90	5932051	23481	0.15	2367358	18589	0.12	8299410	4891	0.03
	1990-00	8029548	41756	0.23	3319044	30913	0.17	11348592	10843	0.06
1970	1970-80	1815525	1728	0.01	772886	1615	0.01	2588411	113	0.00
	1980-90	3930620	2201	0.01	1545807	1372	0.01	5476427	830	0.01
	1990-00	6041967	6627	0.04	2488104	4307	0.02	8530071	2321	0.01
1980	1980-90	2115680	-111	0.00	773038	-126	0.00	2888718	15	0.00
	1990-00	4228944	2398	0.01	1714780	2254	0.01	5943723	145	0.00
1990	1990-00	2114621	1152	0.01	940504	1142	0.01	3055124	10	0.00
Other endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	2021247	1462	0.01	805700	1366	0.01	2826948	96	0.00
1960	1970-80	3836730	3233	0.02	1578283	2679	0.02	5415013	554	0.00
	1980-90	5959642	-4110	-0.03	2343231	-5538	0.03	8302873	1428	0.01
	1990-00	8087857	-16553	-0.09	3269134	-18997	-0.10	11356991	2444	0.01
1970	1970-80	1817358	-105	0.00	771158	-113	0.00	2588517	7	0.00
	1980-90	3938769	-5947	-0.04	1538444	-5992	-0.04	5477213	44	0.00
	1990-00	6063404	-14809	-0.08	2468991	-14806	-0.08	8532395	-3	0.00
1980	1980-90	2116510	-941	-0.01	772213	-951	-0.01	2888724	10	0.00
	1990-00	4237098	-5756	-0.03	1706758	-5768	-0.03	5943856	12	0.00
1990	1990-00	2117063	-1291	-0.01	938084	-1278	-0.01	3055147	-13	0.00
Other digestive & genitourinary diseases										
Fixed at:	1960-70	2022415	295	0.00	804627	294	0.00	2827042	1	0.00
1960	1970-80	3840588	-625	0.00	1574956	-649	0.00	5415544	24	0.00
	1980-90	5954436	1096	0.01	2348436	-333	0.00	8302872	1429	0.01
	1990-00	8064453	6851	0.04	3289063	932	0.01	11353516	5919	0.03
1970	1970-80	1817684	-431	0.00	770784	-487	0.00	2588468	56	0.00
	1980-90	3932893	-71	0.00	1543766	-669	0.00	5476658	599	0.00
	1990-00	6047194	1401	0.01	2483620	-177	0.00	8530814	1578	0.01
1980	1980-90	2117326	-1757	0.01	771393	-1771	-0.01	2888719	14	0.00
	1990-00	4235321	-3980	0.02	1708443	-4083	-0.02	5943764	104	0.00
1990	1990-00	2115782	-9	0.00	939342	-19	0.00	3055124	10	0.00
All other causes										
Fixed at:	1960-70	2023706	-997	-0.01	803363	-971	-0.01	2827070	-26	0.00
1960	1970-80	3843880	-3917	-0.03	1572216	-3389	-0.02	5416096	-528	0.00
	1980-90	5949303	6228	0.04	2355862	7093	0.04	8305165	-864	-0.01
	1990-00	8045302	26002	0.14	3315440	27309	0.15	11360742	-1307	-0.01
1970	1970-80	1816312	941	0.01	772192	921	0.01	2588504	20	0.00
	1980-90	3916049	16773	0.10	1560362	15927	0.10	5476411	846	0.01
	1990-00	6005341	43254	0.24	2524823	41026	0.22	8530164	2228	0.01
1980	1980-90	2113031	2538	0.02	775721	2556	0.02	2888752	-18	0.00
	1990-00	4215641	15701	0.09	1728107	15581	0.09	5943748	120	0.00
1990	1990-00	2114669	1104	0.01	940435	1073	0.01	3055104	31	0.00

TABLE 3.6 Components of Population Change under Observed and Fixed Mortality Conditions, 1960-2000, Black Males

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
OBSERVED MORTALITY										
	1960-70	1759503			1163750			2968396		
	1970-80	3238662			2478193			5686346		
	1980-90	5130400			3811392			8719516		
	1990-00	7053106			5288344			11927407		
ALL CAUSES COMBINED										
Fixed at:	1960-70	1771718	-12215	-0.10	1151367	-12383	-0.11	2968227	169	0.00
1960	1970-80	3236826	1835	0.01	2477813	-380	0.00	5684130	2215	0.02
	1980-90	4922881	207519	1.38	3996979	185587	1.23	8697584	21932	0.15
	1990-00	6539793	513313	3.02	5724651	436307	2.57	11850401	77006	0.45
1970	1970-80	1414402	64756	0.49	1378053	63610	0.48	2716804	1146	0.01
	1980-90	3054062	316834	2.10	2951567	303925	2.02	5738211	12909	0.09
	1990-00	4643705	649898	3.82	4732625	608031	3.58	8917145	41867	0.25
1980	1980-90	1866324	25414	0.17	1358344	25145	0.17	3032901	268	0.00
	1990-00	3686516	127928	0.75	2937204	127053	0.75	6240186	876	0.01
1990	1990-00	1893940	28766	0.17	1505823	28871	0.17	3207996	-105	0.00
INFECTIOUS & PARASITIC DISEASES										
Fixed at:	1960-70	1755748	3756	0.03	1167404	3654	0.03	2968294	102	0.00
1960	1970-80	3222589	16073	0.12	2493503	15310	0.12	5685582	763	0.01
	1980-90	5107560	22840	0.15	3831821	20429	0.14	8717105	2411	0.02
	1990-00	7107135	-54029	-0.32	5230990	-57353	-0.34	11924083	3324	0.02
1970	1970-80	1477139	2019	0.02	1316402	1959	0.01	2717890	60	0.00
	1980-90	3370954	-58	0.00	2647083	-558	0.00	5750619	501	0.00
	1990-00	5379531	-85929	-0.51	4038561	-86032	-0.51	8958908	104	0.00
1980	1980-90	1902189	-10451	-0.07	1322839	-10360	-0.07	3033261	-91	0.00
	1990-00	3920448	-106004	-0.62	2706088	-104063	-0.61	6243002	-1941	-0.01
1990	1990-00	1944452	-21746	-0.13	1455486	-21466	-0.13	3208172	-280	0.00
Tuberculosis–all forms										
Fixed at:	1960-70	1757396	2107	0.02	1165773	2023	0.02	2968312	84	0.00
1960	1970-80	3226232	12429	0.09	2489984	11791	0.09	5685707	638	0.00
	1980-90	5103959	26441	0.18	3835942	24550	0.16	8717625	1891	0.01
	1990-00	7010350	42756	0.25	5327218	38874	0.23	11923526	3881	0.02
1970	1970-80	1477336	1822	0.01	1316242	1799	0.01	2717927	23	0.00
	1980-90	3363167	7729	0.05	2655158	7516	0.05	5750907	213	0.00
	1990-00	5278421	15181	0.09	4139237	14643	0.09	8958473	538	0.00
1980	1980-90	1891358	380	0.00	1333581	382	0.00	3033172	-2	0.00
	1990-00	3812075	2369	0.01	2812555	2404	0.01	6241097	-35	0.00
1990	1990-00	1921610	1096	0.01	1478037	1085	0.01	3207879	12	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HIV infection										
Fixed at:	1960-70	1759503	0	0.00	1163750	0	0.00	2968396	0	0.00
1960	1970-80	3238662	0	0.00	2478193	0	0.00	5686346	0	0.00
	1980-90	5135988	-5588	-0.04	3805861	-5530	-0.04	8719573	-58	0.00
	1990-00	7149527	-96421	-0.57	5193658	-94686	-0.56	11929143	-1736	-0.01
1970	1970-80	1479158	0	0.00	1314443	0	0.00	2717950	0	0.00
	1980-90	3376484	-5588	-0.04	2642111	-5530	-0.04	5751178	-58	0.00
	1990-00	5390024	-96421	-0.57	4029908	-94686	-0.56	8960747	-1736	-0.01
1980	1980-90	1897326	-5588	-0.04	1327669	-5530	-0.04	3033228	-58	0.00
	1990-00	3910866	-96421	-0.57	2715465	-94686	-0.56	6242797	-1736	-0.01
1990	1990-00	1945496	-22790	-0.13	1454465	-22487	-0.13	3208194	-303	0.00
All other infectious & parasitic diseases										
Fixed at:	1960-70	1757854	1649	0.01	1165381	1631	0.01	2968378	18	0.00
1960	1970-80	3235005	3657	0.03	2481724	3532	0.03	5686221	125	0.00
	1980-90	5128418	1982	0.01	3812796	1404	0.01	8718938	578	0.00
	1990-00	7053767	-661	0.00	5286506	-1838	-0.01	11926230	1177	0.01
1970	1970-80	1478962	196	0.00	1314602	159	0.00	2717913	37	0.00
	1980-90	3373111	-2215	-0.01	2645082	-2560	-0.02	5750775	345	0.00
	1990-00	5298353	-4750	-0.03	4118543	-6051	-0.04	8957711	1301	0.01
1980	1980-90	1896978	-5240	-0.03	1327989	-5210	-0.03	3033201	-31	0.00
	1990-00	3826302	-11858	-0.07	2798462	-11689	-0.07	6241231	-169	0.00
1990	1990-00	1922761	-55	0.00	1476887	-65	0.00	3207881	11	0.00
CANCERS										
Fixed at:	1960-70	1766412	-6909	-0.06	1156808	-6943	-0.06	2968362	34	0.00
1960	1970-80	3279851	-41189	-0.31	2436532	-41661	-0.32	5685874	472	0.00
	1980-90	5214725	-84325	-0.56	3725109	-86282	-0.57	8717559	1957	0.01
	1990-00	7161290	-108184	-0.64	5175338	-113006	-0.66	11922585	4821	0.03
1970	1970-80	1488498	-9340	-0.07	1305032	-9411	-0.07	2717879	71	0.00
	1980-90	3407400	-36503	-0.24	2610479	-37163	-0.25	5750460	660	0.00
	1990-00	5337558	-43956	-0.26	4078618	-45976	-0.27	8956991	2020	0.01
1980	1980-90	1895415	-3677	-0.02	1329491	-3708	-0.02	3033139	31	0.00
	1990-00	3808680	5764	0.03	2815584	5433	0.03	6240730	331	0.00
1990	1990-00	1914369	8337	0.05	1485277	8325	0.05	3207879	12	0.00
Cancer–buccal cavity, pharynx, esophagus, & larynx										
Fixed at:	1960-70	1760685	-1182	-0.01	1162572	-1178	-0.01	2968399	-4	0.00
1960	1970-80	3245019	-6357	-0.05	2471846	-6347	-0.05	5686355	-10	0.00
	1980-90	5143578	-13178	-0.09	3798212	-13180	-0.09	8719514	1	0.00
	1990-00	7067162	-14056	-0.08	5274257	-14087	-0.08	11927376	31	0.00
1970	1970-80	1481082	-1924	-0.01	1312517	-1926	-0.01	2717948	2	0.00
	1980-90	3377297	-6400	-0.04	2641224	-6417	-0.04	5751103	17	0.00
	1990-00	5298599	-4996	-0.03	4119545	-5049	-0.03	8958959	53	0.00
1980	1980-90	1891308	430	0.00	1333627	428	0.00	3033168	2	0.00
	1990-00	3808535	5909	0.03	2816041	5890	0.03	6241042	19	0.00
1990	1990-00	1921019	1688	0.01	1478638	1686	0.01	3207889	2	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cancer–trachea, bronchus, & lung										
Fixed at:	1960-70	1763737	-4234	-0.04	1159523	-4227	-0.04	2968402	-7	0.00
1960	1970-80	3265549	-26887	-0.20	2451332	-26861	-0.20	5686372	-26	0.00
	1980-90	5187639	-57239	-0.38	3754187	-57205	-0.38	8719550	-34	0.00
	1990-00	7130026	-76920	-0.45	5211481	-76863	-0.45	11927464	-57	0.00
1970	1970-80	1484859	-5700	-0.04	1308740	-5702	-0.04	2717948	2	0.00
	1980-90	3394927	-24031	-0.16	2623592	-24050	-0.16	5751101	20	0.00
	1990-00	5325747	-32144	-0.19	4092401	-32192	-0.19	8958963	48	0.00
1980	1980-90	1894371	-2633	-0.02	1330566	-2633	-0.02	3033170	-1	0.00
	1990-00	3814456	-12	0.00	2810143	-8	0.00	6241065	-4	0.00
1990	1990-00	1918173	4533	0.03	1481482	4530	0.03	3207888	3	0.00
Cancer–other avoidable forms										
Fixed at:	1960-70	1760411	-907	-0.01	1162813	-937	-0.01	2968366	30	0.00
1960	1970-80	3241121	-2459	-0.02	2475433	-2760	-0.02	5686045	301	0.00
	1980-90	5131910	-1510	-0.01	3808800	-2591	-0.02	8718435	1081	0.01
	1990-00	7052976	130	0.00	5285914	-2430	-0.01	11924847	2560	0.02
1970	1970-80	1479449	-291	0.00	1314116	-327	0.00	2717914	36	0.00
	1980-90	3370319	578	0.00	2647899	257	0.00	5750800	321	0.00
	1990-00	5291504	2099	0.01	4125725	1132	0.01	8958044	967	0.01
1980	1980-90	1892007	-269	0.00	1332922	-277	0.00	3033161	9	0.00
	1990-00	3814472	-27	0.00	2809988	-163	0.00	6240926	135	0.00
1990	1990-00	1922225	481	0.00	1477423	471	0.00	3207881	10	0.00
Cancer–all other forms										
Fixed at:	1960-70	1760081	-578	0.00	1163158	-592	-0.01	2968381	15	0.00
1960	1970-80	3243745	-5083	-0.04	2472904	-5289	-0.04	5686140	206	0.00
	1980-90	5140746	-10346	-0.07	3800137	-11255	-0.07	8718607	909	0.01
	1990-00	7066072	-12966	-0.08	5273090	-15254	-0.09	11925119	2288	0.01
1970	1970-80	1480559	-1401	-0.01	1313010	-1432	-0.01	2717919	32	0.00
	1980-90	3377021	-6125	-0.04	2641214	-6427	-0.04	5750817	303	0.00
	1990-00	5301241	-7638	-0.04	4116003	-8591	-0.05	8958059	952	0.01
1980	1980-90	1892902	-1164	-0.01	1332014	-1185	-0.01	3033149	21	0.00
	1990-00	3814499	-55	0.00	2809915	-236	0.00	6240880	181	0.00
1990	1990-00	1921062	1644	0.01	1478599	1647	0.01	3207894	-3	0.00
CIRCULATORY DISEASES										
Fixed at:	1960-70	1758620	883	0.01	1164585	834	0.01	2968347	49	0.00
1960	1970-80	3185760	52902	0.40	2529992	51799	0.39	5685243	1102	0.01
	1980-90	4955074	175326	1.16	3981813	170421	1.13	8714610	4905	0.03
	1990-00	6700627	352479	2.07	5629518	341175	2.01	11916103	11304	0.07
1970	1970-80	1447926	31232	0.24	1345429	30986	0.24	2717704	246	0.00
	1980-90	3230863	140034	0.93	2785313	137672	0.91	5748758	2362	0.02
	1990-00	4984674	308929	1.82	4427109	302516	1.78	8952598	6413	0.04
1980	1980-90	1873503	18235	0.12	1351381	18182	0.12	3033117	53	0.00
	1990-00	3692431	122013	0.72	2931663	121512	0.71	6240560	501	0.00
1990	1990-00	1906744	15962	0.09	1492924	15972	0.09	3207901	-9	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cerebrovascular disease										
Fixed at:	1960-70	1757768	1735	0.01	1165480	1730	0.01	2968390	6	0.00
1960	1970-80	3213245	25417	0.19	2503418	25225	0.19	5686154	192	0.00
	1980-90	5053780	76620	0.51	3886970	75578	0.50	8718474	1042	0.01
	1990-00	6919358	133748	0.79	5419434	131090	0.77	11924749	2658	0.02
1970	1970-80	1468093	11066	0.08	1325440	10997	0.08	2717882	68	0.00
	1980-90	3315999	54898	0.36	2701880	54238	0.36	5750460	660	0.00
	1990-00	5187248	106355	0.63	4229032	104438	0.61	8957095	1916	0.01
1980	1980-90	1883564	8174	0.05	1341352	8153	0.05	3033149	21	0.00
	1990-00	3781600	32844	0.19	2842768	32617	0.19	6240834	228	0.00
1990	1990-00	1920880	1826	0.01	1478756	1804	0.01	3207869	22	0.00
Rheumatic fever & chronic rheumatic heart disease										
Fixed at:	1960-70	1758573	931	0.01	1164637	887	0.01	2968352	43	0.00
1960	1970-80	3234882	3780	0.03	2481419	3226	0.02	5685792	554	0.00
	1980-90	5118445	11955	0.08	3821357	9965	0.07	8717526	1990	0.01
	1990-00	7031431	21675	0.13	5305667	17323	0.10	11923055	4352	0.03
1970	1970-80	1478536	622	0.00	1315027	584	0.00	2717913	38	0.00
	1980-90	3365086	5810	0.04	2653030	5388	0.04	5750698	422	0.00
	1990-00	5281808	11795	0.07	4135183	10589	0.06	8957806	1205	0.01
1980	1980-90	1891548	190	0.00	1333388	189	0.00	3033169	1	0.00
	1990-00	3813240	1204	0.01	2811304	1153	0.01	6241010	51	0.00
1990	1990-00	1922496	210	0.00	1477159	207	0.00	3207887	4	0.00
Ischemic heart disease										
Fixed at:	1960-70	1768856	-9353	-0.08	1154397	-9353	-0.08	2968396	0	0.00
1960	1970-80	3295255	-56593	-0.43	2421584	-56609	-0.43	5686330	16	0.00
	1980-90	5107636	22764	0.15	3833710	22318	0.15	8719069	447	0.00
	1990-00	6930868	122238	0.72	5409300	120956	0.71	11926125	1282	0.01
1970	1970-80	1462938	16221	0.12	1330607	16165	0.12	2717894	56	0.00
	1980-90	3243790	127106	0.84	2774172	126531	0.84	5750544	576	0.00
	1990-00	5036645	256957	1.51	4379966	255373	1.50	8957427	1585	0.01
1980	1980-90	1876462	15276	0.10	1348463	15264	0.10	3033158	12	0.00
	1990-00	3736507	77937	0.46	2887986	77835	0.46	6240959	103	0.00
1990	1990-00	1913523	9183	0.05	1486132	9180	0.05	3207888	3	0.00
Hypertensive disease										
Fixed at:	1960-70	1753115	6389	0.05	1170096	6346	0.05	2968353	43	0.00
1960	1970-80	3176580	62082	0.47	2539821	61629	0.47	5685892	454	0.00
	1980-90	5038489	91911	0.61	3901913	90521	0.60	8718126	1390	0.01
	1990-00	6927971	125135	0.74	5410530	122186	0.72	11924458	2949	0.02
1970	1970-80	1474939	4219	0.03	1318627	4184	0.03	2717915	35	0.00
	1980-90	3371576	-679	0.00	2646725	-917	-0.01	5750882	238	0.00
	1990-00	5296418	-2815	-0.02	4121189	-3404	-0.02	8958422	589	0.00
1980	1980-90	1890454	1284	0.01	1334467	1268	0.01	3033154	16	0.00
	1990-00	3811857	2587	0.02	2812658	2506	0.01	6240980	81	0.00
1990	1990-00	1923881	-1175	-0.01	1475783	-1169	-0.01	3207897	-6	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Atherosclerosis										
Fixed at:	1960-70	1758718	785	0.01	1164534	784	0.01	2968394	1	0.00
1960	1970-80	3232816	5846	0.04	2484033	5841	0.04	5686340	5	0.00
	1980-90	5119708	10692	0.07	3822066	10674	0.07	8719499	17	0.00
	1990-00	7034367	18739	0.11	5307045	18702	0.11	11927369	38	0.00
1970	1970-80	1478196	962	0.01	1315404	961	0.01	2717949	1	0.00
	1980-90	3367077	3820	0.03	2651454	3813	0.03	5751113	7	0.00
	1990-00	5284152	9451	0.06	4134029	9435	0.06	8958996	16	0.00
1980	1980-90	1890642	1096	0.01	1334295	1096	0.01	3033170	0	0.00
	1990-00	3808964	5480	0.03	2815631	5480	0.03	6241061	0	0.00
1990	1990-00	1922239	468	0.00	1477420	468	0.00	3207891	0	0.00
Other circulatory diseases										
Fixed at:	1960-70	1759164	339	0.00	1164134	383	0.00	2968440	-44	0.00
1960	1970-80	3228952	9709	0.07	2488020	9827	0.07	5686464	-118	0.00
	1980-90	5166372	-35972	-0.24	3775395	-35997	-0.24	8719491	25	0.00
	1990-00	7104651	-51545	-0.30	5236758	-51586	-0.30	11927366	41	0.00
1970	1970-80	1480889	-1730	-0.01	1312664	-1778	-0.01	2717902	48	0.00
	1980-90	3423301	-52404	-0.35	2594776	-52866	-0.35	5750658	462	0.00
	1990-00	5366360	-72758	-0.43	4050727	-73867	-0.43	8957902	1109	0.01
1980	1980-90	1899313	-7575	-0.05	1325621	-7578	-0.05	3033166	4	0.00
	1990-00	3809285	5159	0.03	2815270	5119	0.03	6241022	40	0.00
1990	1990-00	1917224	5483	0.03	1482467	5515	0.03	3207923	-32	0.00
EXTERNAL CAUSES										
Fixed at:	1960-70	1770648	-11144	-0.10	1152806	-10944	-0.09	2968595	-200	0.00
1960	1970-80	3302457	-63795	-0.48	2416882	-61310	-0.47	5688830	-2484	-0.02
	1980-90	5189137	-58737	-0.39	3757038	-54354	-0.36	8723899	-4383	-0.03
	1990-00	7089455	-36349	-0.21	5255571	-32773	-0.19	11930983	-3576	-0.02
1970	1970-80	1460559	18600	0.14	1332781	18339	0.14	2717689	261	0.00
	1980-90	3265368	105528	0.70	2749552	101911	0.68	5747503	3618	0.02
	1990-00	5083606	209996	1.24	4323318	198724	1.17	8947739	11272	0.07
1980	1980-90	1873783	17955	0.12	1350974	17775	0.12	3032990	180	0.00
	1990-00	3765148	49296	0.29	2858545	48394	0.28	6240159	902	0.01
1990	1990-00	1913443	9263	0.05	1486124	9172	0.05	3207801	91	0.00
Motor vehicle accidents										
Fixed at:	1960-70	1763600	-4096	-0.04	1159788	-3962	-0.03	2968530	-135	0.00
1960	1970-80	3248066	-9404	-0.07	2469639	-8554	-0.06	5687195	-850	-0.01
	1980-90	5130870	-470	0.00	3812300	908	0.01	8720894	-1378	-0.01
	1990-00	7039991	13115	0.08	5303534	15190	0.09	11929482	-2075	-0.01
1970	1970-80	1470983	8175	0.06	1322443	8001	0.06	2717776	174	0.00
	1980-90	3338320	32577	0.22	2678650	31008	0.21	5749552	1569	0.01
	1990-00	5230889	62714	0.37	4183291	58697	0.35	8954995	4017	0.02
1980	1980-90	1889924	1814	0.01	1335032	1833	0.01	3033189	-19	0.00
	1990-00	3806003	8441	0.05	2818855	8704	0.05	6241324	-263	0.00
1990	1990-00	1921259	1447	0.01	1478450	1498	0.01	3207942	-51	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Suicide										
Fixed at:	1960-70	1759917	-414	0.00	1163369	-382	0.00	2968428	-32	0.00
1960	1970-80	3242350	-3688	-0.03	2474855	-3338	-0.03	5686696	-350	0.00
	1980-90	5139058	-8658	-0.06	3803509	-7883	-0.05	8720291	-776	-0.01
	1990-00	7068071	-14965	-0.09	5274575	-13768	-0.08	11928603	-1196	-0.01
1970	1970-80	1480236	-1078	-0.01	1313343	-1100	-0.01	2717928	22	0.00
	1980-90	3373839	-2942	-0.02	2644384	-3258	-0.02	5750805	315	0.00
	1990-00	5299444	-5841	-0.03	4117820	-6774	-0.04	8958079	933	0.01
1980	1980-90	1891826	-88	0.00	1333089	-110	0.00	3033148	22	0.00
	1990-00	3815883	-1439	-0.01	2808576	-1575	-0.01	6240925	137	0.00
1990	1990-00	1922787	-81	0.00	1476871	-81	0.00	3207891	0	0.00
Homicide & legal intervention										
Fixed at:	1960-70	1764581	-5077	-0.04	1158728	-5022	-0.04	2968451	-55	0.00
1960	1970-80	3280135	-41473	-0.31	2437643	-40550	-0.31	5687269	-923	-0.01
	1980-90	5190326	-59926	-0.40	3754108	-57284	-0.38	8722158	-2643	-0.02
	1990-00	7135635	-82529	-0.49	5210916	-77427	-0.46	11932508	-5101	-0.03
1970	1970-80	1475614	3544	0.03	1318010	3568	0.03	2717973	-23	0.00
	1980-90	3339485	31411	0.21	2678808	31166	0.21	5750875	245	0.00
	1990-00	5237543	56060	0.33	4179823	55229	0.32	8958181	830	0.00
1980	1980-90	1881171	10567	0.07	1343665	10466	0.07	3033069	101	0.00
	1990-00	3797432	17012	0.10	2826889	16738	0.10	6240787	274	0.00
1990	1990-00	1915925	6782	0.04	1483610	6658	0.04	3207768	123	0.00
Other accidents & injuries										
Fixed at:	1960-70	1761055	-1552	-0.01	1162177	-1573	-0.01	2968374	22	0.00
1960	1970-80	3247735	-9073	-0.07	2469480	-8713	-0.07	5686706	-360	0.00
	1980-90	5119982	10418	0.07	3821395	10004	0.07	8719102	414	0.00
	1990-00	7005278	47828	0.28	5331378	43034	0.25	11922613	4794	0.03
1970	1970-80	1471190	7969	0.06	1322324	7881	0.06	2717863	88	0.00
	1980-90	3326104	44792	0.30	2690944	43302	0.29	5749630	1490	0.01
	1990-00	5195408	98194	0.58	4217288	92694	0.55	8953511	5500	0.03
1980	1980-90	1886069	5669	0.04	1338792	5593	0.04	3033094	76	0.00
	1990-00	3789070	25374	0.15	2834771	24620	0.14	6240307	754	0.00
1990	1990-00	1921590	1116	0.01	1478050	1098	0.01	3207873	18	0.00
SMOKING & ALCOHOL-RELATED DISEASES										
Fixed at:	1960-70	1768469	-8966	-0.08	1154839	-8911	-0.08	2968450	-55	0.00
1960	1970-80	3290063	-51401	-0.39	2427053	-51140	-0.39	5686608	-262	0.00
	1980-90	5225088	-94688	-0.63	3716959	-94432	-0.63	8719771	-256	0.00
	1990-00	7162572	-109466	-0.64	5178748	-109596	-0.64	11927277	130	0.00
1970	1970-80	1418571	60587	0.46	1373370	58928	0.45	2716291	1659	0.01
	1980-90	3154655	216242	1.43	2849514	201873	1.34	5736751	14369	0.10
	1990-00	4872937	420665	2.47	4506330	381736	2.25	8920082	38929	0.23
1980	1980-90	1890856	882	0.01	1334043	845	0.01	3033133	37	0.00
	1990-00	3790240	24205	0.14	2833932	23781	0.14	6240638	423	0.00
1990	1990-00	1913405	9301	0.05	1486219	9267	0.05	3207858	34	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Chronic liver disease & cirrhosis										
Fixed at:	1960-70	1763048	-3544	-0.03	1160250	-3500	-0.03	2968440	-44	0.00
1960	1970-80	3256603	-17941	-0.14	2460478	-17715	-0.13	5686572	-226	0.00
	1980-90	5153765	-23366	-0.16	3788249	-23143	-0.15	8719739	-223	0.00
	1990-00	7070065	-16959	-0.10	5271230	-17114	-0.10	11927252	155	0.00
1970	1970-80	1480044	-885	-0.01	1313525	-918	-0.01	2717917	33	0.00
	1980-90	3363636	7260	0.05	2654492	6850	0.05	5750710	410	0.00
	1990-00	5264424	29178	0.17	4152349	27755	0.16	8957588	1423	0.01
1980	1980-90	1888652	3086	0.02	1336249	3050	0.02	3033134	36	0.00
	1990-00	3796095	18349	0.11	2828091	17940	0.11	6240652	409	0.00
1990	1990-00	1919621	3085	0.02	1480008	3056	0.02	3207862	29	0.00
MEDICALLY AVOIDABLE CONDITIONS										
Fixed at:	1960-70	1739715	19789	0.17	1183060	19310	0.17	2967916	479	0.00
1960	1970-80	3060671	177991	1.35	2650737	172544	1.31	5680899	5447	0.04
	1980-90	4736558	393842	2.61	4180358	368966	2.45	8694640	24875	0.17
	1990-00	6387723	665383	3.91	5879288	590944	3.48	11852968	74439	0.44
1970	1970-80	1436975	42183	0.32	1356000	41558	0.32	2717324	626	0.00
	1980-90	3212098	158798	1.05	2800422	152780	1.01	5745102	6018	0.04
	1990-00	4976545	317058	1.87	4418393	293800	1.73	8935753	23258	0.14
1980	1980-90	1886379	5359	0.04	1338491	5292	0.04	3033103	67	0.00
	1990-00	3768147	46298	0.27	2855735	45584	0.27	6240348	713	0.00
1990	1990-00	1911814	10892	0.06	1487767	10815	0.06	3207815	77	0.00
Diabetes mellitus										
Fixed at:	1960-70	1760398	-895	-0.01	1162845	-905	-0.01	2968385	10	0.00
1960	1970-80	3242386	-3724	-0.03	2474361	-3832	-0.03	5686238	108	0.00
	1980-90	5133473	-3073	-0.02	3807867	-3525	-0.02	8719064	452	0.00
	1990-00	7064235	-11129	-0.07	5276205	-12139	-0.07	11926396	1011	0.01
1970	1970-80	1478045	1114	0.01	1315536	1094	0.01	2717930	20	0.00
	1980-90	3366417	4480	0.03	2651916	4275	0.03	5750915	205	0.00
	1990-00	5294149	-547	0.00	4123518	-1075	-0.01	8958483	529	0.00
1980	1980-90	1892246	-508	0.00	1332682	-517	0.00	3033162	8	0.00
	1990-00	3823638	-9194	-0.05	2800940	-9211	-0.05	6241043	18	0.00
1990	1990-00	1925314	-2608	-0.02	1474346	-2606	-0.02	3207893	-2	0.00
Other avoidable endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	1759409	95	0.00	1163819	69	0.00	2968370	25	0.00
1960	1970-80	3236318	2344	0.02	2480251	2059	0.02	5686060	285	0.00
	1980-90	5120286	10113	0.07	3820188	8797	0.06	8718199	1317	0.01
	1990-00	7031967	21139	0.12	5305924	17580	0.10	11923848	3559	0.02
1970	1970-80	1477992	1167	0.01	1315549	1106	0.01	2717890	61	0.00
	1980-90	3363346	7551	0.05	2654586	6945	0.05	5750514	606	0.00
	1990-00	5276861	16741	0.10	4139489	14896	0.09	8957165	1846	0.01
1980	1980-90	1890904	834	0.01	1334016	817	0.01	3033153	17	0.00
	1990-00	3810680	3764	0.02	2813817	3666	0.02	6240963	98	0.00
1990	1990-00	1922078	628	0.00	1477590	638	0.00	3207900	-9	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Pneumonia & influenza										
Fixed at:	1960-70	1788618	-29115	-0.25	1134602	-29149	-0.25	2968362	34	0.00
1960	1970-80	3287256	-48594	-0.37	2429185	-49008	-0.37	5685932	414	0.00
	1980-90	5222230	-91830	-0.61	3716275	-95117	-0.63	8716229	3287	0.02
	1990-00	7151875	-98769	-0.58	5176127	-112217	-0.66	11913959	13448	0.08
1970	1970-80	1524535	-45377	-0.34	1269004	-45439	-0.34	2717888	62	0.00
	1980-90	3480820	-109924	-0.73	2536880	-110761	-0.73	5750283	837	0.01
	1990-00	5431909	-138307	-0.81	3981622	-142972	-0.84	8954347	4665	0.03
1980	1980-90	2006673	-114935	-0.76	1218263	-114936	-0.76	3033169	1	0.00
	1990-00	4001513	-187069	-1.10	2623060	-187091	-1.10	6241040	21	0.00
1990	1990-00	1990938	-68232	-0.40	1408705	-68247	-0.40	3207876	15	0.00
Other respiratory diseases										
Fixed at:	1960-70	1761061	-1558	-0.01	1162178	-1573	-0.01	2968381	15	0.00
1960	1970-80	3243245	-4583	-0.03	2473463	-4730	-0.04	5686199	147	0.00
	1980-90	5139804	-9404	-0.06	3801238	-10154	-0.07	8718766	750	0.00
	1990-00	7062419	-9313	-0.05	5276464	-11879	-0.07	11924840	2567	0.02
1970	1970-80	1477675	1484	-0.01	1315887	1444	0.01	2717910	40	0.00
	1980-90	3372037	-1141	-0.01	2646154	-1487	-0.01	5750774	346	0.00
	1990-00	5293080	523	0.00	4123899	-695	0.00	8957794	1217	0.01
1980	1980-90	1894005	-2267	-0.02	1330940	-2259	-0.02	3033178	-8	0.00
	1990-00	3816759	-2315	-0.01	2807920	-2231	-0.01	6241145	-84	0.00
1990	1990-00	1921306	1401	0.01	1478360	1408	0.01	3207898	-7	0.00
Other avoidable digestive & genitourinary diseases										
Fixed at:	1960-70	1756783	2720	0.02	1166435	2685	0.02	2968361	35	0.00
1960	1970-80	3216232	22429	0.17	2500019	21826	0.17	5685742	604	0.00
	1980-90	5085952	44448	0.29	3853430	42038	0.28	8717105	2410	0.02
	1990-00	6980124	72982	0.43	5355801	67457	0.40	11921881	5526	0.03
1970	1970-80	1474320	4839	0.04	1319193	4751	0.04	2717862	88	0.00
	1980-90	3355424	15472	0.10	2662337	14696	0.10	5750343	777	0.01
	1990-00	5261721	31882	0.19	4154354	29760	0.18	8956890	2122	0.01
1980	1980-90	1890975	763	0.01	1333942	743	0.00	3033150	20	0.00
	1990-00	3807261	7183	0.04	2817183	7032	0.04	6240910	152	0.00
1990	1990-00	1921139	1567	0.01	1478504	1552	0.01	3207876	15	0.00
Certain causes of perinatal mortality										
Fixed at:	1960-70	1755422	4081	0.03	1167831	4081	0.03	2968395	0	0.00
1960	1970-80	3206973	31688	0.24	2509779	31586	0.24	5686244	102	0.00
	1980-90	5050576	79824	0.53	3887632	76240	0.51	8715932	3584	0.02
	1990-00	6900971	152135	0.90	5420824	132480	0.78	11907752	19655	0.12
1970	1970-80	1471634	7525	0.06	1321968	7525	0.06	2717951	-1	0.00
	1980-90	3340227	30670	0.20	2678129	30487	0.20	5750937	183	0.00
	1990-00	5225495	68108	0.40	4188708	64114	0.38	8955018	3994	0.02
1980	1980-90	1888951	2787	0.02	1335987	2788	0.02	3033170	0	0.00
	1990-00	3799498	14946	0.09	2825030	14879	0.09	6240994	67	0.00
1990	1990-00	1917866	4840	0.03	1481792	4840	0.03	3207891	0	0.00

(continued)

TABLE 3.6 Components of Population Change, 1960-2000, Black Males (continued)

Fixed Mortality Scenario	Decade	Cum. Pop. Growth	Addl. Pop. under Observed	Addl. Pop. as % of Actual	Cum. Total Deaths	Deaths Prev. under Obs.	Deaths Prev. as % of Actual	Cum. Total Births	Addl. Births under Observed	Addl. Births as % of Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
All other avoidable conditions										
Fixed at:	1960-70	1759040	463	0.00	1164077	327	0.00	2968259	136	0.00
1960	1970-80	3234420	4242	0.03	2480904	2711	0.02	5684815	1531	0.01
	1980-90	5120063	10337	0.07	3816593	5201	0.03	8714380	5136	0.03
	1990-00	7031702	21404	0.13	5298363	10019	0.06	11916022	11385	0.07
1970	1970-80	1478714	445	0.00	1314768	326	0.00	2717831	119	0.00
	1980-90	3369419	1478	0.01	2648248	606	0.00	5750249	871	0.01
	1990-00	5288035	5568	0.03	4127725	3131	0.02	8956575	2437	0.01
1980	1980-90	1891852	-114	0.00	1333069	-130	0.00	3033154	16	0.00
	1990-00	3812621	1823	0.01	2811822	1671	0.01	6240909	152	0.00
1990	1990-00	1921938	768	0.00	1477709	757	0.00	3207881	11	0.00
Other endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases										
Fixed at:	1960-70	1757212	2292	0.02	1165941	2191	0.02	2968295	101	0.00
1960	1970-80	3233349	5313	0.04	2482924	4731	0.04	5685764	582	0.00
	1980-90	5130443	-43	0.00	3809849	-1543	-0.01	8718016	1499	0.01
	1990-00	7062985	-9879	-0.06	5275899	-12445	-0.07	11924841	2566	0.02
1970	1970-80	1479423	-265	0.00	1314170	-273	0.00	2717943	8	0.00
	1980-90	3376625	-5729	-0.04	2641866	-5776	-0.04	5751073	47	0.00
	1990-00	5306476	-12874	-0.08	4111723	-12870	-0.08	8959015	-3	0.00
1980	1980-90	1892397	-659	0.00	1332530	-669	0.00	3033160	10	0.00
	1990-00	3818062	-3618	-0.02	2806521	-3630	-0.02	6241049	13	0.00
1990	1990-00	1922884	-178	0.00	1476788	-164	0.00	3207904	-13	0.00
Other digestive & genitourinary diseases										
Fixed at:	1960-70	1759150	354	0.00	1164103	352	0.00	2968394	1	0.00
1960	1970-80	3239328	-666	-0.01	2477502	-691	-0.01	5686321	25	0.00
	1980-90	5126329	4071	0.03	3813963	2571	0.02	8718016	1500	0.01
	1990-00	7039659	13447	0.08	5295575	7232	0.04	11921192	6215	0.04
1970	1970-80	1479582	-423	0.00	1313961	-482	0.00	2717891	59	0.00
	1980-90	3368797	2099	0.01	2649112	1471	0.01	5750491	629	0.00
	1990-00	5286981	6621	0.04	4129558	4964	0.03	8957354	1657	0.01
1980	1980-90	1892418	-680	0.00	1332504	-695	0.00	3033155	15	0.00
	1990-00	3814009	435	0.00	2810477	326	0.00	6240952	109	0.00
1990	1990-00	1921884	822	0.00	1477763	811	0.00	3207880	11	0.00
All other causes										
Fixed at:	1960-70	1762637	-3134	-0.03	1160644	-3106	-0.03	2968423	-27	0.00
1960	1970-80	3254816	-16154	-0.12	2462593	-15600	-0.12	5686901	-555	0.00
	1980-90	5146189	-15789	-0.10	3796510	-14882	-0.10	8720423	-907	-0.01
	1990-00	7053110	-4	0.00	5289712	1368	0.01	11928779	-1372	-0.01
1970	1970-80	1479945	-787	-0.01	1313635	-808	-0.01	2717929	21	0.00
	1980-90	3357564	13333	0.09	2660086	12444	0.08	5750232	888	0.01
	1990-00	5249840	43763	0.26	4166017	41423	0.24	8956672	2339	0.01
1980	1980-90	1889667	2071	0.01	1335289	2090	0.01	3033189	-19	0.00
	1990-00	3793298	21146	0.12	2831171	21020	0.12	6240935	126	0.00
1990	1990-00	1917920	4787	0.03	1481706	4754	0.03	3207859	32	0.00

TABLE 3.7 Cumulative Proportionate Impact of Mortality Change on 2000 Population, Broad Cause Groups by Time Period, Race, and Sex

Cause of Death/Time Period	White Females	White Males	Black Females	Black Males
Mortality change since 1960:				
All causes combined	3.48%	3.84%	5.04%	3.02%
Infectious & parasitic diseases	-0.02%	-0.10%	-0.04%	-0.32%
Cancers	-0.10%	-0.23%	-0.09%	-0.64%
Circulatory diseases	3.04%	3.17%	3.09%	2.07%
External causes	0.03%	0.00%	0.12%	-0.21%
Smoking & alcohol-related diseases	-0.45%	-0.34%	-0.34%	-0.64%
Medically avoidable conditions	2.73%	2.45%	4.65%	3.91%
Mortality change since 1970:				
All causes combined	2.46%	3.54%	3.41%	3.82%
Infectious & parasitic diseases	-0.05%	-0.19%	-0.16%	-0.51%
Cancers	-0.17%	-0.04%	-0.12%	-0.26%
Circulatory diseases	2.25%	2.71%	2.12%	1.82%
External causes	0.23%	0.39%	0.41%	1.24%
Smoking & alcohol-related diseases	0.20%	0.82%	0.67%	2.47%
Medically avoidable conditions	1.21%	1.35%	1.85%	1.87%
Mortality change since 1980:				
All causes combined	0.53%	1.63%	0.56%	0.75%
Infectious & parasitic diseases	-0.05%	-0.21%	-0.22%	-0.62%
Cancers	-0.10%	0.04%	-0.05%	0.03%
Circulatory diseases	0.88%	1.20%	0.66%	0.72%
External causes	0.07%	0.20%	0.08%	0.29%
Smoking & alcohol-related diseases	-0.13%	0.07%	-0.01%	0.14%
Medically avoidable conditions	0.14%	0.26%	0.23%	0.27%
Mortality change since 1990:				
All causes combined	-0.01%	0.18%	0.04%	0.17%
Infectious & parasitic diseases	-0.01%	-0.01%	-0.06%	-0.13%
Cancers	-0.10%	0.03%	0.00%	0.05%
Circulatory diseases	0.08%	0.14%	0.07%	0.09%
External causes	0.00%	0.01%	0.01%	0.05%
Smoking & alcohol-related diseases	-0.02%	0.02%	0.01%	0.05%
Medically avoidable conditions	-0.01%	0.02%	0.02%	0.06%

TABLE 3.8 Cumulative Proportionate Impact of Mortality Change on 2000 Population, Selected Cause Groups by Time Period, Race, and Sex

Cause of Death/Time Period	White Females	White Males	Black Females	Black Males
Mortality change since 1960:				
Cancer–trachea, bronchus, & lung	-0.45%	-0.37%	-0.28%	-0.45%
Cancer–other avoidable forms	0.38%	0.14%	0.23%	0.00%
Cerebrovascular diseases	1.04%	0.72%	1.28%	0.79%
Ischemic heart disease	1.45%	2.22%	0.66%	0.72%
Hypertensive disease	0.57%	0.32%	1.14%	0.74%
Pneumonia & influenza	-0.88%	-0.84%	0.55%	-0.58%
Other avoidable digestive & genitourin.	0.25%	0.37%	0.37%	0.43%
Certain causes of perinatal mortality	0.33%	0.48%	0.65%	0.90%
Mortality change since 1970:				
Cancer–trachea, bronchus, & lung	-0.34%	-0.12%	-0.20%	-0.19%
Cerebrovascular diseases	0.76%	0.58%	0.86%	0.63%
Ischemic heart disease	1.75%	2.38%	1.50%	1.51%
Other circulatory diseases	-0.45%	-0.38%	-0.39%	-0.43%
Motor vehicle accidents	0.07%	0.22%	0.12%	0.37%
Other accidents & injuries	0.13%	0.24%	0.21%	0.58%
Pneumonia & influenza	-0.93%	-0.88%	0.27%	-0.81%
Certain causes of perinatal mortality	0.16%	0.24%	0.27%	0.40%
Mortality change since 1980:				
HIV infection	-0.02%	-0.18%	-0.17%	-0.57%
Cerebrovascular diseases	0.24%	0.18%	0.24%	0.19%
Ischemic heart disease	0.60%	0.96%	0.33%	0.46%
Other accidents & injuries	0.03%	0.08%	0.06%	0.15%
Chronic liver disease & cirrhosis	0.03%	0.05%	0.07%	0.11%
Pneumonia & influenza	-1.01%	-0.99%	-0.02%	-1.10%
Certain causes of perinatal mortality	0.04%	0.05%	0.07%	0.09%
All other causes	-0.05%	0.01%	0.09%	0.12%
Mortality change since 1990:				
HIV infection	-0.01%	-0.01%	-0.06%	-0.13%
Cancer–trachea, bronchus, & lung	-0.02%	0.02%	-0.01%	0.03%
Ischemic heart disease	0.08%	0.12%	0.04%	0.05%
Other circulatory diseases	-0.01%	0.01%	0.02%	0.03%
Diabetes mellitus	-0.01%	-0.01%	-0.02%	-0.02%
Pneumonia & influenza	-0.40%	-0.38%	0.00%	-0.40%
Certain causes of perinatal mortality	0.00%	0.01%	0.02%	0.03%
All other causes	-0.03%	-0.01%	0.01%	0.03%

NOTE: Cause groups shown rank highest on proportionate impact of mortality change across race and sex groups.

FIGURE 3.1 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, All Causes Combined

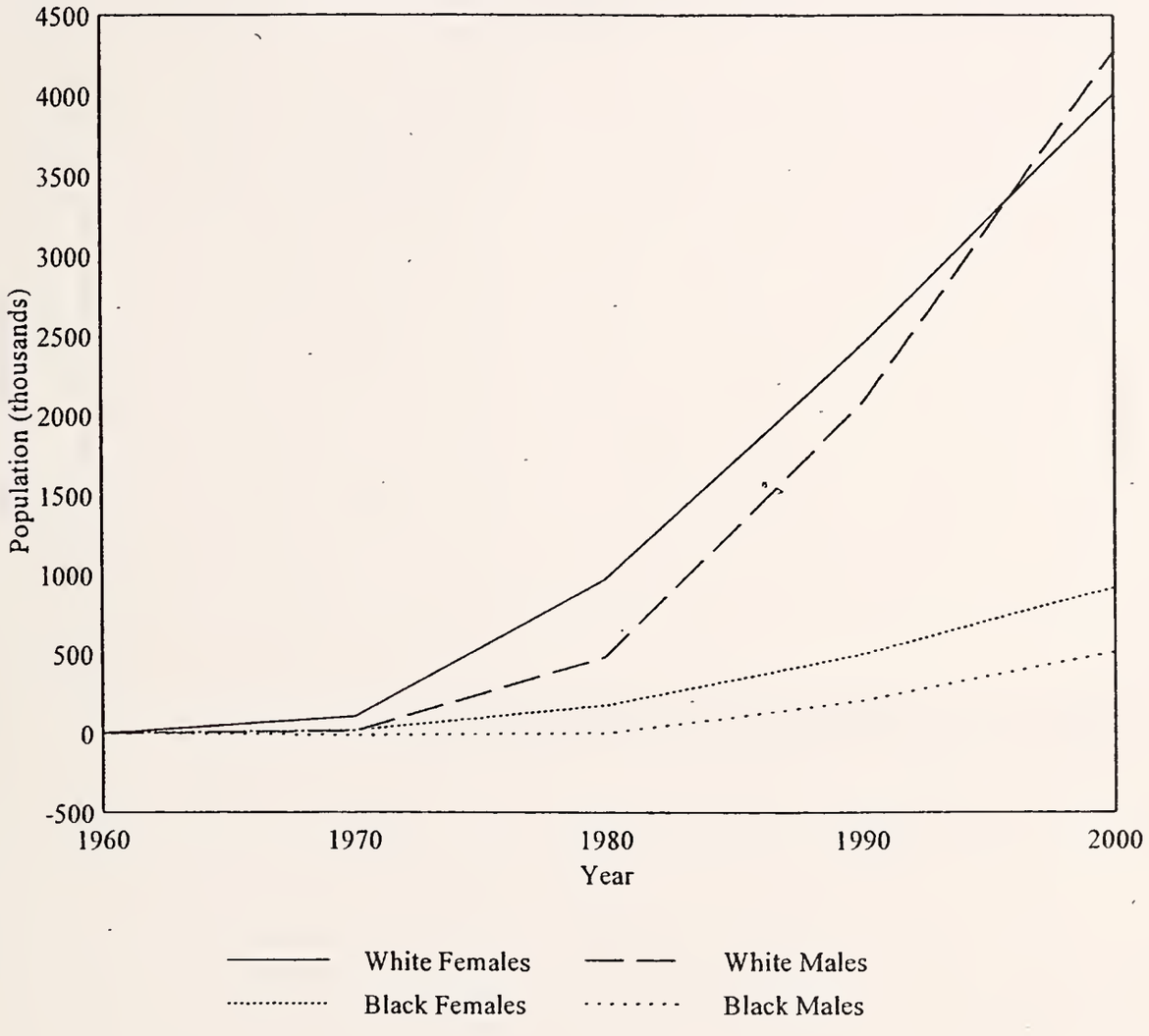


FIGURE 3.2 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Infectious and Parasitic Diseases

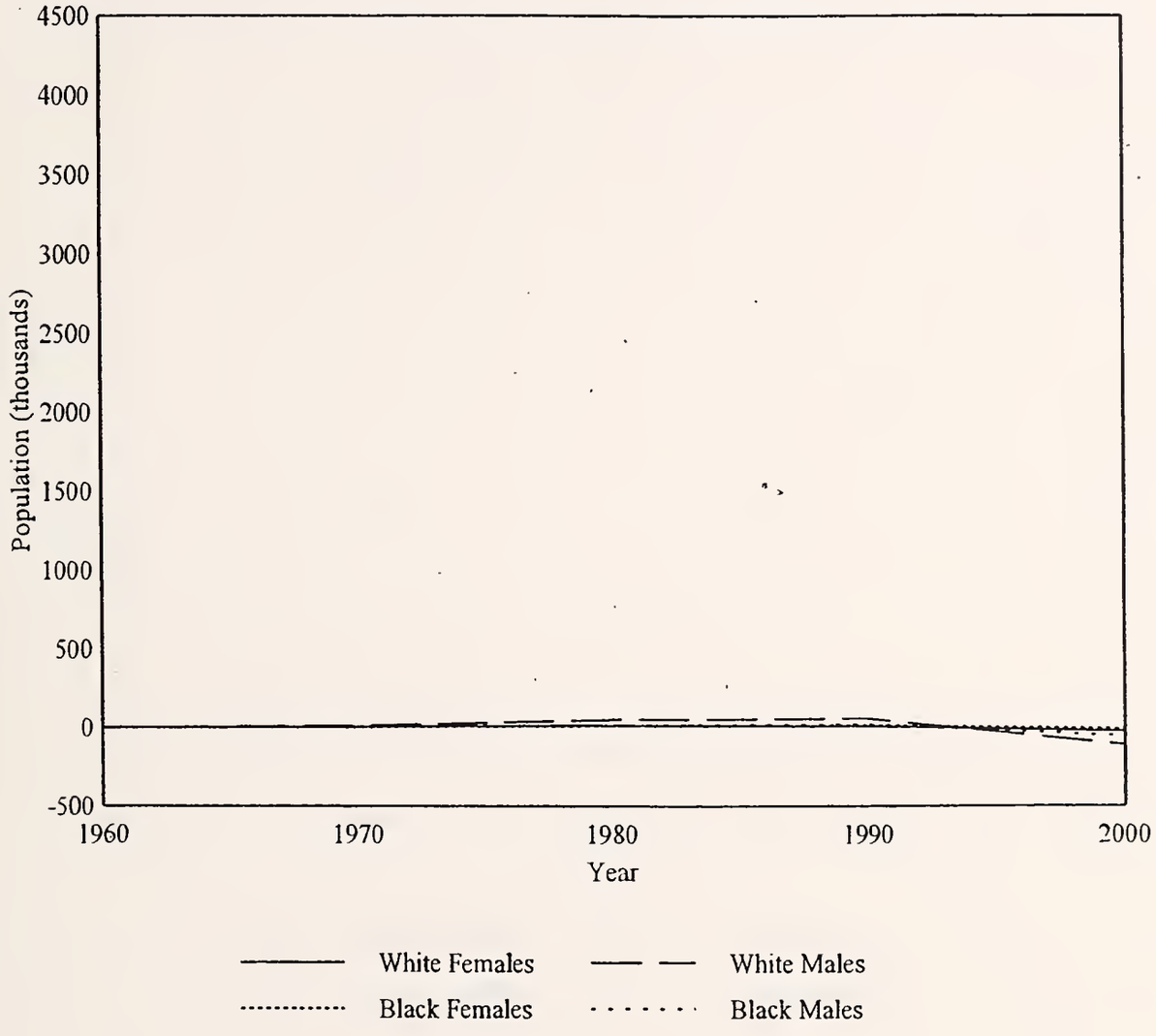


FIGURE 3.3 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Cancer

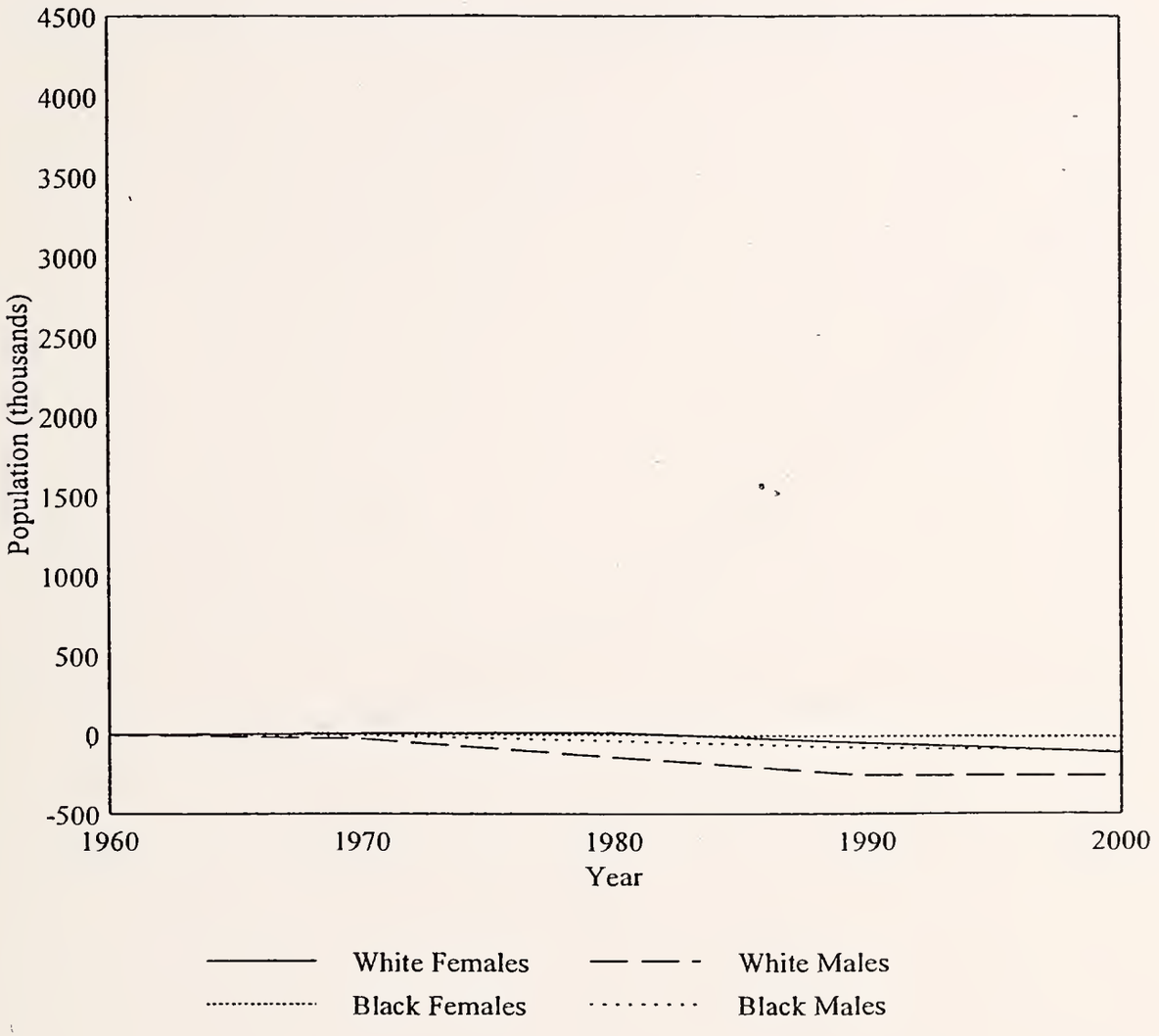


FIGURE 3.4 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Circulatory Diseases

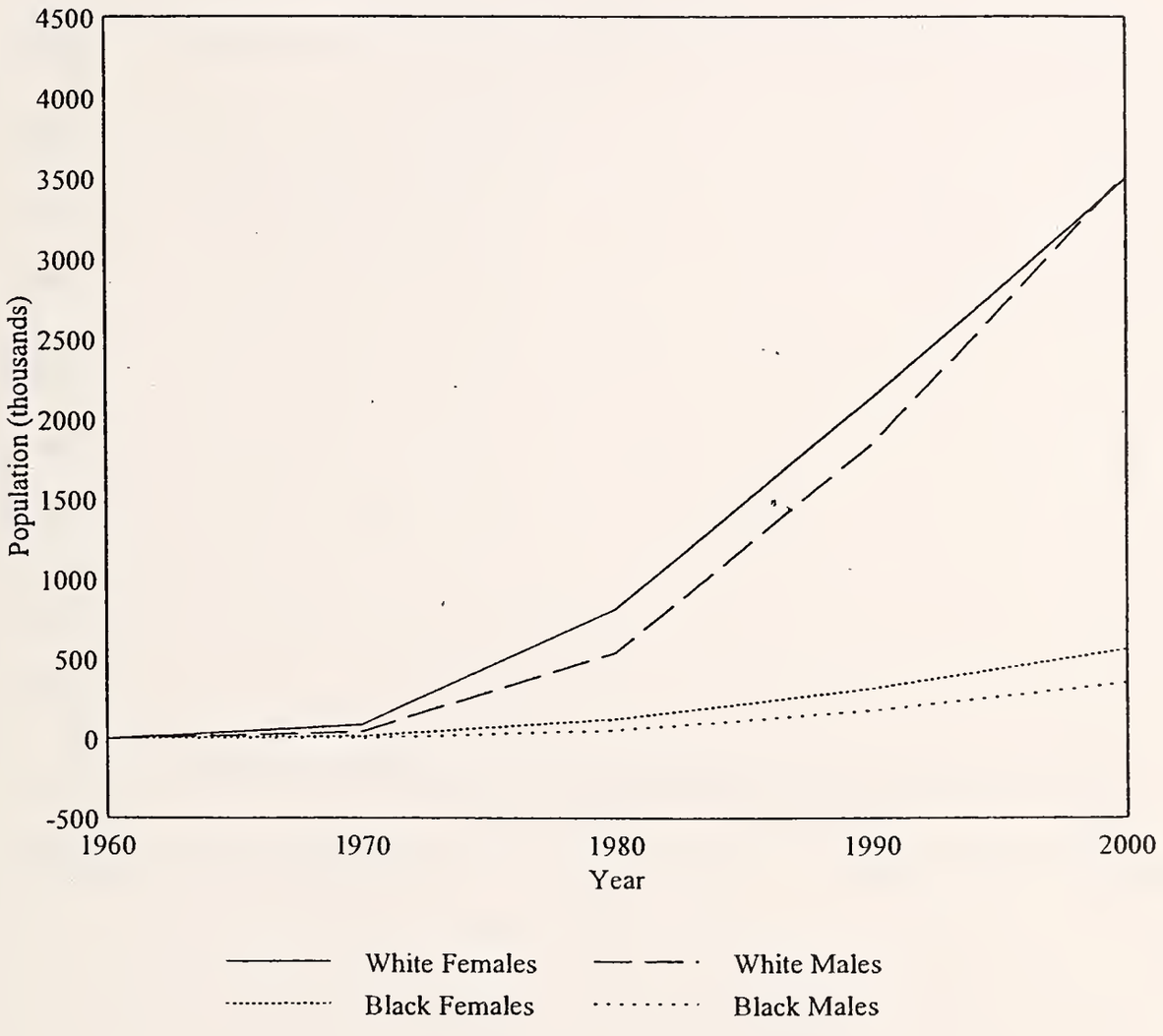


FIGURE 3.5 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, External Causes

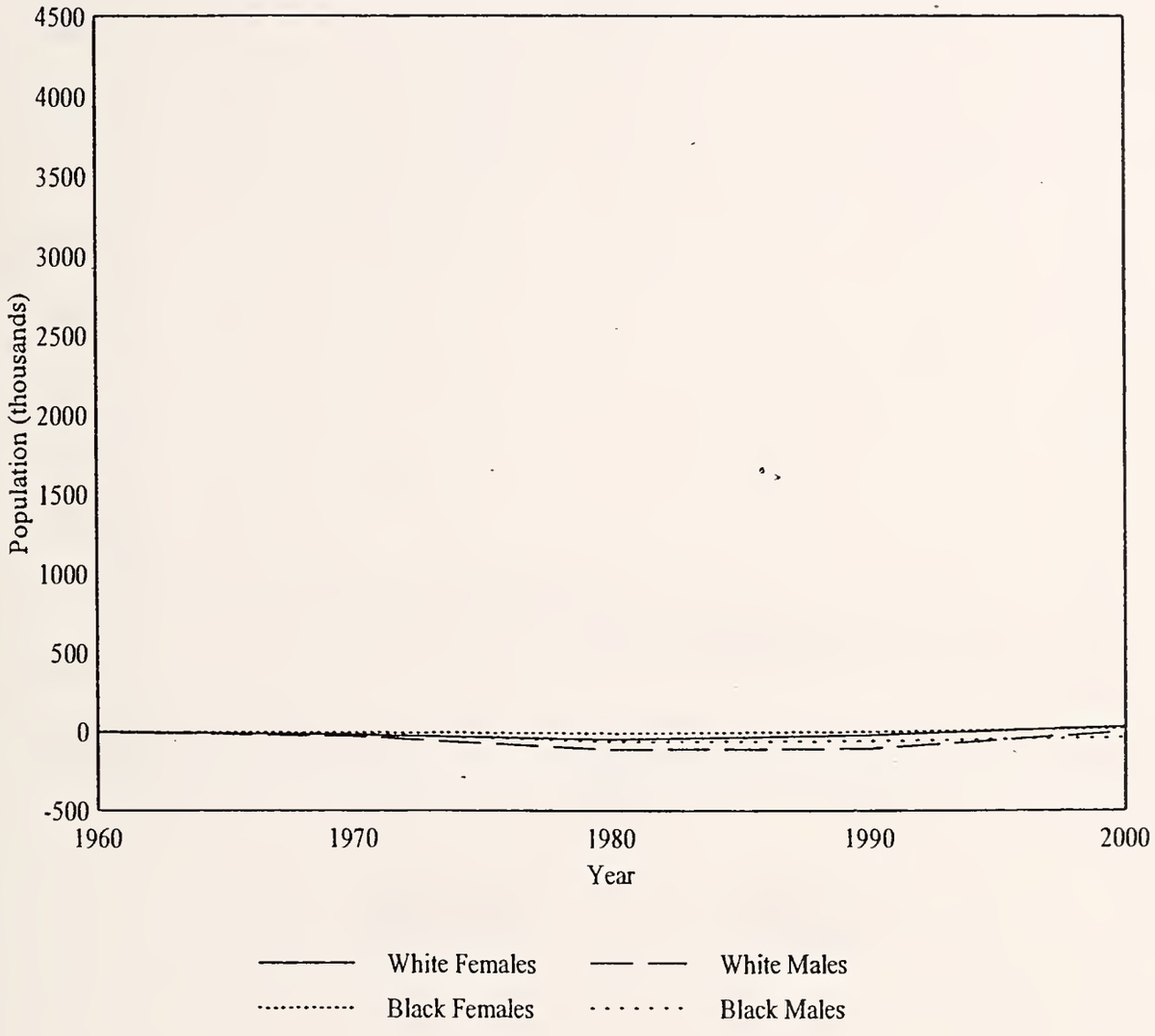


FIGURE 3.6 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Smoking and Alcohol-Related Diseases

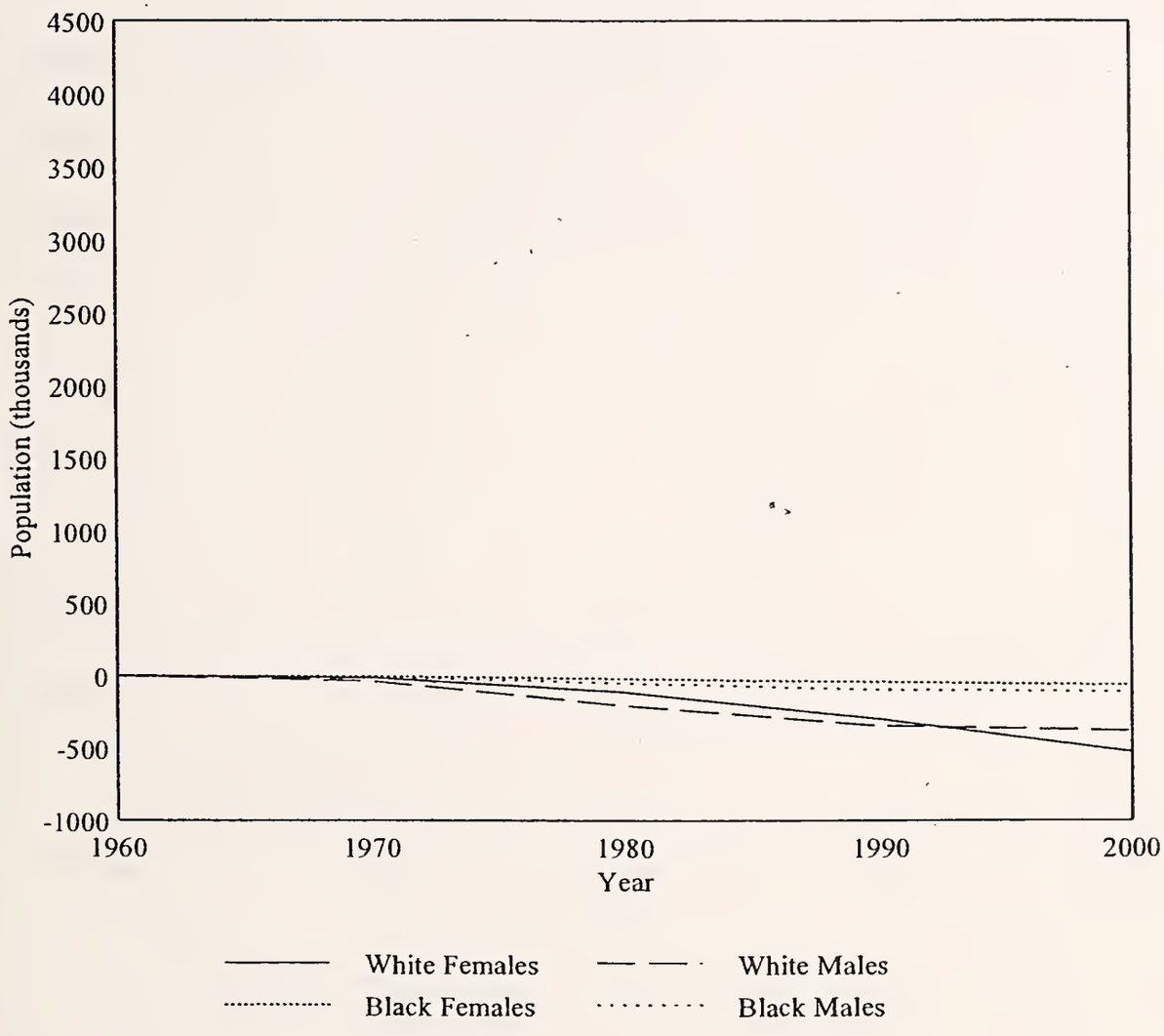
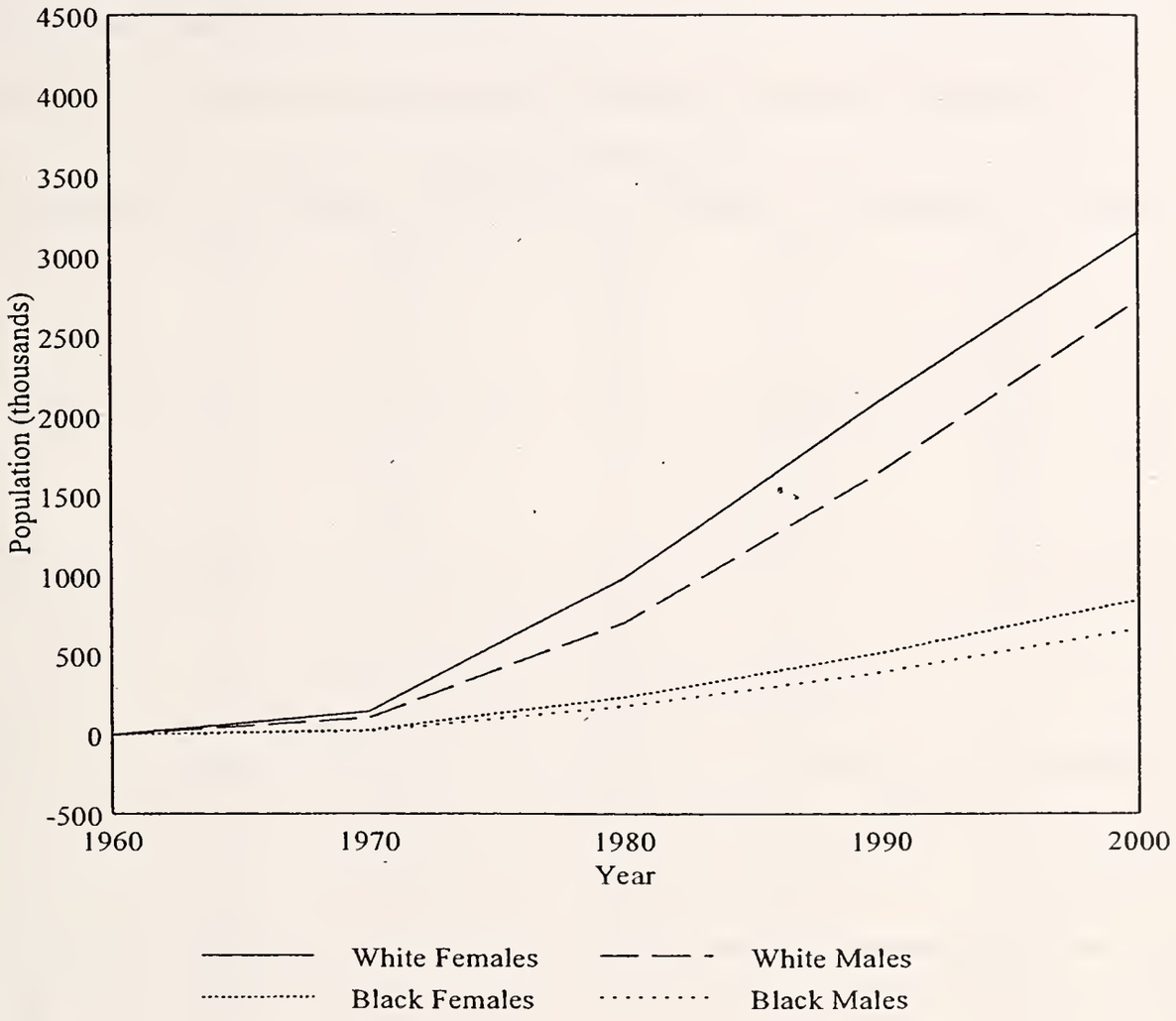


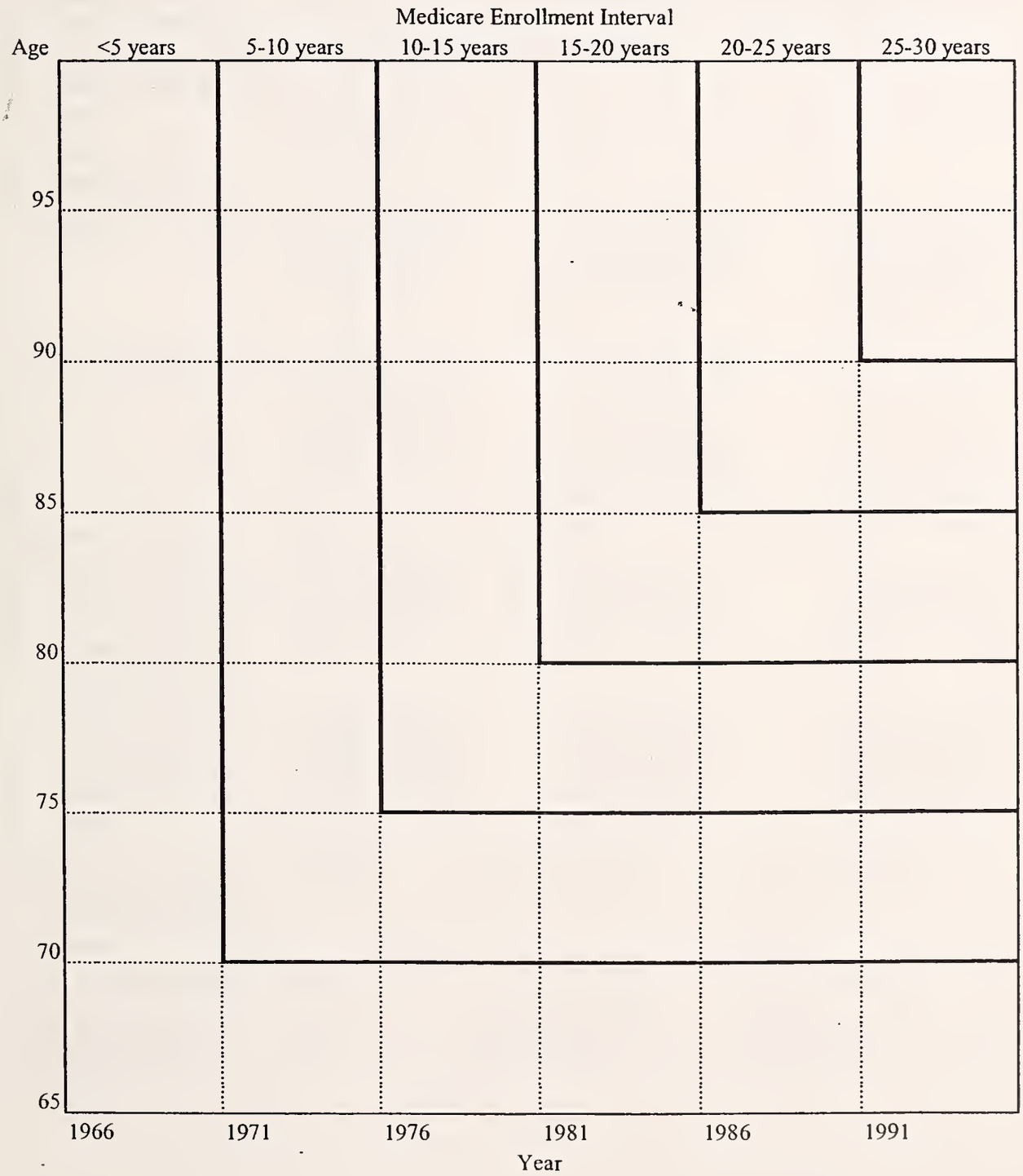
FIGURE 3.7 Cumulative Population Growth Resulting from Mortality Change Since 1960 by Race and Sex, Medically Avoidable Conditions



APPENDICES

Appendix to Chapter 2

FIGURE A2.1: Lexis Diagram Showing Duration of Enrollment in Medicare by Age and Year



Appendix to Chapter 3

TABLE A3.1 List of Cause Groups, Including International Classification of Disease Numbers and Comparability Ratios

Title	Seventh Revision	CR†	Eighth Revision	CR	Ninth Revision
1. Tuberculosis, all forms	001-019	---	010-019	0.767	010-018,137
2. HIV infection (1984-95)	---	---	---	---	279.1,042*-044*
3. Other infectious & parasitic diseases	020-138	---	000-009,020-136	0.836	001-009,020-136, 138-139
4. Cancer, buccal cavity, pharynx, esophagus, & larynx	140-150,161	1.060*	140-150,161	1.012*	140-150,161
5. Cancer, trachea, bronchus, & lung	162-163	1.032*	162	1.001*	162
6. Cancer, other avoidable forms	153-155,170-174, 176,178,181-192, 194,201,204	---	153-155,172-180, 182,184.0,186, 188,190,193,201, 204-207	---	153-154,155.0, 172-174,179-180, 182,184.0,186, 188,190,193,201, 204-208
7. Cancer, all other forms	151-152,156-160, 164-165,175,177, 179-180,193,195-200,202-203,205-239	---	151-152,156-160, 163-171,181,183, 184.1-185,187, 189,191-192,194-200,202-203,208-239	---	151-152,155.1-160,163-171,175, 181,183,184.1-185,187,189,191-192,194-200,202-203,210-239
8. Diabetes mellitus	260	0.997	250	0.999	250
9. Other avoidable endocrine, metabolic, immunity, nutritional, blood nervous system, & sense organ diseases	250-254,280-286, 290-293,295,340, 353,385,387,391-393	---	240-246,260-269, 280-286.0,320, 345,374-375,381-383	---	240-246,260-269, 280-286.0, 320, 345,365-366,381-383
10. Other endocrine, metabolic, immunity, nutritional, blood, nervous system, & sense organ diseases	270-277,287-289, 294,296-299,341-352,354-384,386, 388-390,394-398	---	251-258,270-279, 286.1-289,321-344,346-73,376-380,384-389	---	251-259,270-279, 286.1-289,321-344,346-364,367-380,384-389
11. Cerebrovascular disease	330-334	0.990	430-438	1.005	430-438
12. Rheumatic fever & chronic rheumatic heart disease	400–416	1.152	390-398	0.665	390-398
13. Ischemic heart disease	420	1.146	410-414	0.878	410-414
14. Hypertensive disease	440-447	0.394*	400-404	2.062	401-405
15. Atherosclerosis	450	0.896	440	1.065	440

(continued)

TABLE A3.1 List of Cause Groups (continued)

Title	Seventh Revision	CR	Eighth Revision	CR	Ninth Revision
16. Other circulatory diseases	421-434,451-468	---	420-429,441-458	1.858*	415-429,441-459
17. Pneumonia & influenza	480-493	1.044	470-486	0.926	480-487
18. Other respiratory diseases	240-241,470-475, 500-527	---	460-466,490-519	---	460-478,490-519
19. Chronic liver disease & cirrhosis	581	1.006	571	1.011	571
20. Other avoidable digestive & genitourinary diseases	530-535,540-543, 550-570,584-585, 590-600,602,604, 608,610,620-621, 630-637	---	520-525,531-535, 540-560,574-575, 580-590,592,594, 598,600,610-611, 620-629	---	520-525,531-535, 540-553,560,574-575.1,576.1,580-590,592,594,598, 600,610-629
21. Other digestive & genitourinary diseases	536-539,544-545, 571-580,582-583, 586-587,601,603, 605-607,609,611-617,622-626	---	526-530,536-537, 561-570,572-573, 576-577,591,593, 595-597,599,601-607,612-616	---	526-530,536-537, 555-558,562-570, 572-573,575.2-576.0,576.2-579, 591,593,595-597, 599,601-608
22. Certain causes of perinatal mortality	760-776	0.918	760-779	1.077	760-779
23. Other avoidable conditions	242-245,640-689, 690-716,720-730, 737,745-749,754-756	---	630-678,680-709, 710-720,727,735-738,746-747,749-751	---	630-676,680-709, 710-716,725-730, 734-737,745-747, 749-751
24. Motor vehicle accidents	E810-E835	0.992	E810-E823	1.012	E810-E825
25. Suicide	E970-E979	0.947	E950-E959	1.003	E950-E959
26. Homicide & legal intervention	E980-E985	0.997	E960-E978	1.007	E960-E978
27. Other accidents & injuries	E800-E802,E840-E965,E990-E999	---	E800-E807,E825-E949,E980-E999	---	E800-E807,E826-E949,E980-E999
28. All other causes	300-326,731-736, 738-744,750-753, 757-759,780-795	---	290-315,721-726, 728-734,740-745, 748,752-759,780-796	---	290-319,717-724, 731-733,738-739, 740-744,748,752-759,780-799

NOTE: †Comparability ratios.
---, comparability ratio not available.
Asterisks (*) indicate that comparability ratios shown do not refer to the exact set of conditions in the cause group (NCHS 1975a, 1980).

TABLE A3.2 Comparison of Populations Projected to 2000 under Observed Mortality Conditions with Census Populations

Age	White Females			White Males		
	Actual	Census	Actual/Census	Actual	Census	Actual/Census
0-4	7733445	7313000	1.057	8108083	7678000	1.056
5-9	7935699	7660000	1.036	8307230	8048000	1.032
10-14	7818914	7497000	1.043	8174247	7895000	1.035
15-19	7417977	7581000	0.979	7731727	8073000	0.958
20-24	6910208	7002000	0.987	7159176	7376000	0.971
25-29	7198795	7223000	0.997	7406529	7295000	1.015
30-34	7899555	7950000	0.994	8072186	7990000	1.010
35-39	9160494	9207000	0.995	9291060	9307000	0.998
40-44	9129455	9209000	0.991	9200704	9243000	0.995
45-49	8371004	8160000	1.026	8234349	8052000	1.023
50-54	7428944	7138000	1.041	7118612	6908000	1.030
55-59	5845636	5699000	1.026	5526205	5380000	1.027
60-64	4704014	4727000	0.995	4315904	4332000	0.996
65-69	4310710	4394000	0.981	3820177	3796000	1.006
70-74	4242309	4325000	0.981	3437537	3447000	0.997
75-79	3767651	3827000	0.984	2685707	2759000	0.973
80-84	2704996	2729000	0.991	1579694	1653000	0.956
85+	2642598	2663000	0.992	1013022	1112000	0.911
TOTAL	115222403	114304000	1.008	111182148	110344000	1.008
Age	Black Females			Black Males		
	Actual	Census	Actual/Census	Actual	Census	Actual/Census
0-4	1433776	1376000	1.042	1501513	1415000	1.061
5-9	1598965	1548000	1.033	1666563	1598000	1.043
10-14	1509013	1518000	0.994	1563389	1569000	0.996
15-19	1404736	1497000	0.938	1436384	1549000	0.927
20-24	1331833	1365000	0.976	1332263	1334000	0.999
25-29	1338847	1365000	0.981	1314455	1250000	1.052
30-34	1376033	1421000	0.968	1328852	1257000	1.057
35-39	1494420	1538000	0.972	1413316	1365000	1.035
40-44	1475675	1462000	1.009	1324558	1290000	1.027
45-49	1266235	1215000	1.042	1101747	1026000	1.074
50-54	990172	932000	1.062	845241	759000	1.114
55-59	737717	726000	1.016	613054	564000	1.087
60-64	588944	606000	0.972	469644	451000	1.041
65-69	495955	534000	0.929	375890	399000	0.942
70-74	423832	437000	0.970	294880	308000	0.957
75-79	332429	341000	0.975	206976	218000	0.949
80-84	213688	217000	0.985	118443	116000	1.021
85+	231263	222000	1.042	90718	93000	0.975
TOTAL	18243534	18320000	0.996	16997883	16561000	1.026

SOURCE: Actual population is from author's calculations; see text for details on data sources. Census population is from U.S. Bureau of the Census (2000).

BIBLIOGRAPHY

Adler, Gerald S. 1995. "Medicare Beneficiaries Rate Their Medical Care: New Data from the MCBS." Health Care Financing Review 16:175-87.

Aiken, Linda H. and Karl D. Bays. 1984. "The Medicare Debate -- Round One." New England Journal of Medicine 311:1196-200.

Allison, Paul D. 1995. Survival Analysis Using the SAS System. Cary: SAS Institute, Inc.

Anderson, Roger R., Paul Sorlie, Eric Backlund, Norman Johnson, and George A. Kaplan. 1996. "Mortality Effects of Community Socioeconomic Status." Epidemiology 8:42-47.

Bentham, Graham. 1988. "Migration and Morbidity: Implications for Geographical Studies of Disease." Social Science and Medicine 26:49-54.

Bouvier, Leon F., John J. Macisco, Jr., and Alvan Zarate. 1976. "Toward a Framework for the Analysis of Differential Migration: The Case of Education." Pp. 24-36 in A. H. Richmond and D. Kubat (eds.). Internal Migration. Beverly Hills: Sage.

Boys, Richard James, Donald Peter Forster, and Péter Józan. 1991. "Mortality from Causes of Death Amenable and Non-Amenable to Medical Care: The Experience of Eastern Europe." British Medical Journal 303:879-83.

Cadwallader, Martin. 1992. Migration and Residential Mobility. Madison: University of Wisconsin Press.

Cassel, Christine K., Richard W. Besdine, and Lydia C. Siegel. 1999. "Restructuring Medicare for the Next Century: What Will Beneficiaries Really Need?" Health Affairs 18:118-31.

Centers for Disease Control and Prevention. 1990. "Alcohol-Related Mortality and Years of Potential Life Lost–United States, 1987." Morbidity and Mortality Weekly Report 39:173-78.

_____. 1991. "Mortality Attributable to HIV Infection/AIDS–United States, 1981-1990." Morbidity and Mortality Weekly Report 40:41-44.

_____. 1993a. "Cigarette-Attributable Mortality and Years of Potential Life Lost–United States, 1990." Morbidity and Mortality Weekly Report 42:645-49.

_____. 1993b. "Mortality Trends for Selected Smoking-Related Cancers and Breast Cancer–United States, 1950-1990." Morbidity and Mortality Weekly Report 42:863-66.

_____. 1997a. "Cigarette-Attributable Mortality and Years of Potential Life Lost–United States, 1984." Morbidity and Mortality Weekly Report 46:444-51.

_____. 1997b. "Mortality Patterns–Preliminary Data, 1996." Morbidity and Mortality Weekly Report 46:941-44.

Charlton, J. R. H., R. M. Hartley, R. Silver, and W. W. Holland. 1983. "Geographical Variation in Mortality from Conditions Amenable to Medical Intervention in England and Wales." Lancet 1(8326):691-96.

Charlton, John R. H. and Ramon Velez. 1986. "Some International Comparisons of Mortality Amenable to Medical Intervention." British Medical Journal 292:295-301.

Coale, Ansley J. 1956. "The Effects of Changes in Mortality and Fertility on Age Composition." Milbank Memorial Fund Quarterly 34:79-114.

Condran, Gretchen A. and Samuel H. Preston. 1994. "Child Mortality Differences, Personal Health Care Practices, and Medical Technology: The United States, 1900-1930." Pp. 171-224 in L. C. Chen, A. Kleinman, and N. C. Ware (eds.), Health and Social Change in International Perspective. Cambridge: Harvard University Press.

Crimmins, Eileen M. 1981. "The Changing Pattern of American Mortality, 1940-1977, and Its Implications for the Future." Population and Development Review 7:229-54.

Crimmins, Eileen M., Yashuhiko Saito, and Dominique Ingegneri. 1997. "Trends in Disability-Free Life Expectancy in the United States, 1970-1990." Population and Development Review 23:555-72.

Cox, David R. 1972. "Regression Models and Life Tables." Journal of the Royal Statistical Society B34:187-220.

Davis, Karen and Roger Reynolds. 1976. "The Impact of Medicare and Medicaid on Access to Medical Care." Pp. 391-425 in R. N. Rossetti (ed.), The Role of Health Insurance in the Health Services Sector. New York: National Bureau of Economic Research.

Dennis, Sam Joseph. 1989. African-American Exodus and White Migration, 1950-1970. New York: Garland Publishing.

Doll, Richard and Richard Peto. 1978. "Cigarette Smoking and Bronchial Carcinoma: Dose and Time Relationships among Regular Smokers and Lifelong Non-Smokers." Journal of Epidemiology and Community Health 32:303-13.

Drake, David F. 1978. "Does Money Spent on Health Care Really Improve U.S. Health Status?" Hospitals 52(20):63-65.

Elo, Irma T. 1996. Unpublished estimates of age-specific fertility rates and net Puerto Rican migration for African Americans, 1960-1990. University of Pennsylvania, Philadelphia.

_____. 2001. "New African American Life Tables from 1935-40 to 1985-90." Demography 38:97-114.

Elo, Irma T. and Samuel H. Preston. 1992. "Effects of Early-Life Conditions on Adult Mortality: A Review." Population Index 58:186-212.

_____. 1994. "Estimating African American Mortality from Inaccurate Data." Demography 31:427-58.

_____. 1996. "Educational Differentials in Mortality: United States, 1979-85." Social Science and Medicine 42:47-57.

Ewbank, Douglas C. 1987. "History of Black Mortality and Health before 1940." Milbank Quarterly 65(Supplement 1):100-28.

Ewbank, Douglas C. and Samuel H. Preston. 1990. "Personal Health Behaviour and the Decline of Infant and Child Mortality: The United States, 1900-1930." Pp. 116-49 in J. C. Caldwell et al. (ed.), What We Know About the Health Transition: The Cultural, Social, and Behavioural Determinants of Health. Canberra: Australia National University.

Fang, Jing, Shantha Madhavan, and Michael H. Alderman. 1996. "The Association Between Birthplace and Mortality from Cardiovascular Causes among Black and White Residents of New York City." New England Journal of Medicine 335:1545-51.

_____. 1997. "Nativity, Race, and Mortality: Influence of Region of Birth on Mortality of US-Born Residents of New York City." Human Biology 69:533-44.

Farley, Reynolds. 1996. The New American Reality. New York: Russell Sage.

Farley, Reynolds and Walter R. Allen. 1987. The Color Line and the Quality of Life in America. New York: Russell Sage.

Feldman, Jacob J., Diane M. Makuc, Joel C. Kleinman, and Joan Cornoni-Huntley. 1989. "National Trends in Educational Differentials in Mortality." American Journal of Epidemiology 129:919-33.

Fligstein, Neil. 1981. Going North. New York: Academic Press.

Franks, Peter, Carolyn M. Clancy, and Marthe R. Gold. 1993. "Health Insurance and Mortality: Evidence from a National Cohort." Journal of the American Medical Association 270:737-41.

Friedman, Bernard. 1976. "Mortality, Disability, and the Normative Economic of Medicare." Pp. 365-84 in R. N. Rossetti (ed.), The Role of Health Insurance in the Health Services Sector. New York: National Bureau of Economic Research.

Fuchs, Victor R. 1999. "Health Care for the Elderly: How Much? Who Will Pay for It?" Health Affairs 18:11-21.

Gardner, Paula, Harry M. Rosenberg and Ronald W. Wilson. 1996. "Leading Causes of Death by Age, Sex, Race, and Hispanic Origin: United States, 1992." Vital and Health Statistics, Series 20, Number 29. Hyattsville: National Center for Health Statistics.

Garfinkel, Lawrence and Edwin Silverberg. 1990. "Lung Cancer and Smoking Trends in the United States over the Past 25 Years." Annals of the New York Academy of Sciences 609:146-54.

Geronimus, Arline T., John Bound, and Timothy A. Waidmann. 1999. "Poverty, Time, and Place: Variations in Excess Mortality Across Selected US Populations." Journal of Epidemiology and Community Health 53:325-34.

Geronimus, Arline T., John Bound, Timothy A. Waidmann, Marianne M. Hillemeier, and Patricia B. Burns. 1996. "Excess Mortality among Blacks and Whites in the United States." New England Journal of Medicine 335:1552-58.

Goldman, Lee and E. Francis Cook. 1984. "The Decline in Ischemic Heart Disease Mortality Rates: An Analysis of the Comparative Effects of Medical Interventions and Changes in Lifestyles." Annals of Internal Medicine 101:825-36.

Gornick, Marian. 1976. "Ten Years of Medicare: Impact on the Covered Population." Social Security Bulletin 39(7):3-21.

Gornick, Marian, Jay N. Greenberg, Paul W. Eggers, and Allen Dobson. 1985. "Twenty Years of Medicare and Medicaid: Covered Populations, Use of Benefits, and Program Expenditures." Health Care Financing Review Annual Supplement:13-59.

Gornick, Marian E., Joan L. Warren, Paul W. Eggers, James D. Lubitz, Nancy De Lew, Margaret H. Davis, and Barbara S. Cooper. 1996. "Thirty Years of Medicare: Impact on the Covered Population." Health Care Financing Review 18:179-237.

Greenberg, Michael and Dona Schneider. 1992. "Region of Birth and Mortality of Blacks in the United States." International Journal of Epidemiology 21:324-28.

_____. 1995. "The Cancer Burden of Southern-Born African-Americans: Analysis of a Social-Geographic Legacy." Milbank Memorial Fund Quarterly 73:599-620.

Grove, Robert D. and Hetzel, Alice M. 1968. Vital Statistics Rates in the United States, 1940-1960. Washington: National Center for Health Statistics.

Haan, Mary, George Kaplan, and Terry Camacho. 1987. "Poverty and Health: Prospective Evidence from the Alameda County Study." American Journal of Epidemiology 125:989-98.

Hadley, Jack. 1988. "Medicare Spending and Mortality Rates of the Elderly." Inquiry 25:485-93.

Hadley, Jack, Earl P. Steinberg, and Judith Feder. 1991. "Comparison of Uninsured and Privately Insured Hospital Patients: Condition on Admission, Resource Use, and Outcome" Journal of the American Medical Association 265:374-79.

Harburg, Ernest, John C. Erfurt, Catherine Chape, Louise S. Hauenstein, William J. Schull, and M.A. Schork. 1973. "Socioecological Stressor Areas and Black-White Blood Pressure: Detroit." Journal of Chronic Diseases 26:595-611.

Herd, Denise. 1985. "Migration, Cultural Transformation, and the Rise of Black Liver Cirrhosis Mortality." British Journal of Addiction 80:397-410.

Hermalin, Albert I. 1966. "The Effect of Changes in Mortality Rates on Population Growth and Age Distribution in the United States." Milbank Memorial Fund Quarterly 44:451-68.

Heuveline, Patrick. 1997. The Heuristic Potential of Cohort-Component Projections: Three Essays in Population Dynamics. Ph.D. Dissertation, University of Pennsylvania.

Hill, Mark E., Samuel H. Preston, Ira Rosenwaike, and Jake F. Dunagan. 2000. "Childhood Conditions Predicting Survival to Advanced Age among White Americans." Paper presented at the Annual Meeting of the Population Association of America, Los Angeles.

Himes, Christine L. 1994. "Age Patterns of Mortality and Cause-of-Death Structures in Sweden, Japan, and the United States." Demography 31:633-50.

Himes, Christine L., Samuel H. Preston, and Gretchen A. Condran. 1994. "A Relational Model of Mortality at Older Ages in Low Mortality Countries." Population Studies 48:269-91.

Hoffmann, Carolanne H. 1964. "Health Insurance Coverage: United States, July 1962 - June 1963." Vital and Health Statistics, Series 10, Number 11. Washington: National Center for Health Statistics.

Holland, W. W. (ed.) 1991. European Community Atlas of 'Avoidable Death,', Second Edition, Volume One. New York: Oxford University Press.

_____. (ed.) 1993. European Community Atlas of 'Avoidable Death,', Second Edition, Volume Two. New York: Oxford University Press.

House, James S., Ronald C. Kessler, A. Regula Herzog, Richard P. Mero, Ann M. Kinney, and Martha J. Breslow. 1990. "Age, Socioeconomic Status, and Health." The Milbank Quarterly 68:383-411.

House, James S., James M. Lepowski, Ann M. Kinney, Richard P. Mero, Ronald C. Kessler, and A. Regula Herzog. 1994. "The Social Stratification of Aging and Health." Journal of Health and Social Behavior 35:213-34.

Hull, Diana. 1979. "Migration, Adaptation, and Illness: A Review." Social Science and Medicine 13A:25-36.

Hummer, Robert A., Richard G. Rogers, and Isaac W. Eberstein. 1998. "Sociodemographic Differentials in Adult Mortality: A Review of Analytic Approaches." Population and Development Review 24:553-78.

Hummer, Robert A., Richard G. Rogers, Charles B. Nam, and Felicia B. LeClere. 1999. "Race/Ethnicity, Nativity, and U.S. Adult Mortality." Social Science Quarterly 80:136-53.

Iglehart, John K. 1999. "The American Health Care System--Medicaid." New England Journal of Medicine 340:403-08.

Johnson, Daniel M. and Rex R. Campbell. 1981. Black Migration in America. Durham: Duke University Press.

Keyfitz, Nathan and Wilhelm Flieger. 1968. World Population: An Analysis of Vital Data. Chicago: University of Chicago Press.

_____. 1990. World Population Growth and Aging: Demographic Trends in the Late Twentieth Century. Chicago: University of Chicago Press.

Kington, Raynard, David Carlisle, Dan McCaffrey, Hector Myers, and Walter Allen. 1998. "Racial Differences in Functional Status among Elderly U.S. Migrants from the South." Social Science and Medicine 47:831-40.

Kitagawa, Evelyn M. and Philip M. Hauser. 1973. Differential Mortality in the United States. Cambridge: Harvard University Press.

Klebba, A. Joan. 1982. "Mortality from Diseases Associated with Smoking: United States, 1960-77." Vital and Health Statistics, Series 20, Number 17. Hyattsville: National Center for Health Statistics.

Kochanek, Kenneth D., Jeffrey D. Maurer, and Harry M. Rosenberg. 1994. "Why Did Black Life Expectancy Decline from 1984 through 1989 in the United States?" American Journal of Public Health 84:938-44.

Lanska, Douglas J. and Patrick M. Peterson. 1995. "Effects of Interstate Migration on the Geographic Distribution of Stroke Mortality in the United States." Stroke 26:554-61.

LeClere, Felicia B., Richard G. Rogers, and Kimberley Peters. 1997. "Ethnicity and Mortality in the United States: Individual and Community Correlates." Social Forces 76:169-98.

Lee, Everett S. 1966. "A Theory of Migration." Demography 3:47-57.

Lee, Ronald D. and Lawrence R. Carter. 1992. "Modeling and Forecasting U.S. Mortality." Journal of the American Statistical Association 87:659-71.

Lemann, Nicholas. 1991. The Promised Land: The Great Migration and How It Changed America. New York: Knopf.

Link, Bruce G. and Jo Phelan. 1995. "Social Conditions as Fundamental Causes of Disease." Journal of Health and Social Behavior Extra Issue:80-94.

Long, Stephen H. and Russell F. Settle. 1984. "Medicare and the Disadvantaged Elderly: Objectives and Outcomes." Milbank Memorial Fund Quarterly 62:609-56.

Long, Larry H. and Lynne R. Heltman. 1975. "Migration and Income Differences between Black and White Men in the North." American Journal of Sociology 80:1391-409.

Mackenbach, Johan P., Anton E. Kunst, Caspar W. N. Looman, J. Dik F. Habbema, Paul J. van der Maas. 1988a. "Regional Differences in Mortality from Conditions Amenable to Medical Intervention in The Netherlands: A Comparison of Four Time Periods." Journal of Epidemiology and Community Health 42:325-32.

Mackenbach, Johan P., Caspar W. N. Looman, Anton E. Kunst, J. Dik F. Habbema, Paul J. van der Maas. 1988b. "Post-1950 Mortality Trends and Medical Care: Gains in Life Expectancy Due to Declines in Mortality from Conditions Amenable to Medical Intervention in The Netherlands." Social Science and Medicine 27:889-94.

Mackenbach, Johan P., Karien Stronks, and Anton E. Kunst. 1989. "The Contribution of Medical Care to Inequalities in Health: Differences Between Socio-Economic Groups in Decline of Mortality from Conditions Amenable to Medical Intervention." Social Science and Medicine 29:369-76.

Mancuso, Thomas F. and Carol K. Redmond. 1975. "Heart Disease Mortality Among Black Migrants: A Study of Ohio Residents (1960-1967)." American Heart Journal 90:380-88.

Manton, Kenneth G., Eric Stallard, and Larry Corder. 1995. "Changes in Morbidity and Chronic Disability in the U.S. Elderly Population: Evidence from the 1982, 1984, and 1989 National Long Term Care Surveys." Journals of Gerontology: Social Science 50B:S194-S204.

Manton, Kenneth G. and James W. Vaupel. 1995. "Survival After the Age of 80 in the United States, Sweden, France, England, and Japan." New England Journal of Medicine 333:1232-35.

Marks, Carole. 1989. Farewell–We're Good and Gone: The Great Black Migrations. Bloomington: Indiana University Press.

Marmot, M. G., A. M. Adelstein, and L. Bulusu. 1984. "Lessons from the Study of Immigrant Mortality." Lancet 1(8392):1455-57.

Marshall, Stephen W., Ichiro Kawachi, Neil Pearce, and Barry Borman. 1993. "Social Class Differences in Mortality from Diseases Amenable to Medical Intervention in New Zealand." International Journal of Epidemiology 22:255-61.

Martin, Joyce A., Betty L. Smith, T. J. Mathews, and Stephanie J. Ventura. 1999. "Births and Deaths: Preliminary Data for 1998." National Vital Statistics Reports 47(25). Hyattsville: National Center for Health Statistics.

Massey, Douglas S. and Nancy A. Denton. 1993. American Apartheid. Cambridge: Harvard University Press.

McBride, David. 1991. From TB to AIDS. Albany: State University of New York Press.

McClellan, Mark and Haruko Noguchi. 1998. "Technological Change in Heart-Disease Treatment: Does High Tech Mean Low Value?" American Economic Review 88:90-96.

McCord, Colin and Harold P. Freeman. 1990. "Excess Mortality in Harlem." New England Journal of Medicine 322:173-77.

McKinlay, John B., Sonja M. McKinlay, and Robert Beaglehold. 1989. "A Review of the Evidence Concerning the Impact of Medical Measures on Recent Mortality and Morbidity in the United States." International Journal of Health Services 19:181-208.

Monk, Mary and M. Ellen Warshauser. 1978. "A Methodologic Problem in Studies of Migrant Populations." Journal of Chronic Diseases 31:347-52.

Moon, Marilyn. 1993. Medicare Now and In the Future. Washington: Urban Institute Press.

Mosley, W. Henry and Ronald Gray. 1993. "Childhood Precursors of Adult Morbidity and Mortality in Developing Countries: Implications for Health Programs." Pp. 69-100 in J. N. Grabble and S. H. Preston (eds.), The Epidemiological Transition: Policy and Planning Implications for Developing Countries. Washington: National Academy Press.

National Center for Health Statistics. 1963. Vital Statistics of the United States, 1960, Volume II - Mortality, Part A. Washington: Public Health Service.

_____. 1967. Methodology of the National, Regional, and State Life Tables. Life Tables: 1959-61 Volume 1, Number 4. Washington: Public Health Service.

_____. 1968. Vital Statistics of the United States, 1966, Volume II - Mortality, Part A. Washington: Public Health Service.

_____. 1971. "Leading Components of Upturn in Mortality for Men, United States--1952-1967." Vital and Health Statistics, Series 20, Number 11. Rockville: Public Health Service.

_____. 1974. Vital Statistics of the United States, 1970, Volume II - Mortality, Part A. Rockville: Public Health Service.

_____. 1975a. "Comparability of Mortality Statistics for the Seventh and Eighth Revisions of the International Classification of Diseases, United States." Vital and Health Statistics, Series 2, Number 66. Washington: Public Health Service.

_____. 1975b. Methodology of the National and State Life Tables. U.S. Decennial Life Tables for 1969-71 Volume 1, Number 3. Rockville: Public Health Service.

_____. 1980. "Estimates of Selected Comparability Ratios Based on Dual Coding of 1976 Death Certificates by the Eighth and Ninth Revisions of the International Classification of Disease." Monthly Vital Statistics Report Volume 28, Number 11. Hyattsville: Public Health Service.

_____. 1989. "Advance Report of Final Mortality Statistics, 1987." Monthly Vital Statistics Report Volume 38, Number 5, Supplement. Hyattsville: Public Health Service.

_____. 1994. Vital Statistics of the United States, 1990, Volume II - Mortality, Part A. Hyattsville: Public Health Service.

_____. 1997a. Methodology of the National and State Life Tables. U.S. Decennial Life Tables for 1989-91 Volume 1, Number 2. Hyattsville: National Center for Health Statistics.

_____. 1999a. Health, United States, 1999, With Aging and Health Chartbook. Hyattsville: National Center for Health Statistics.

_____. 1999b. Vital Statistics of the United States, 1993, Volume I–Natality. Hyattsville: National Center for Health Statistics.

_____. 2000. "Deaths: Final Data for 1998." National Vital Statistics Reports Volume 48, Number 11. Hyattsville: National Center for Health Statistics.

Pampalon, Robert. 1993. "Avoidable Mortality in Québec and Its Regions." Social Science and Medicine 37:823-31.

Pappas, Gregory, Susan Queen, Wilbur Hadden, and Gail Fisher. 1993. "The Increasing Disparity in Mortality Between Socioeconomic Groups in the United States, 1960 and 1986." New England Journal of Medicine 329:103-09.

Poikolainen, Kari and Juhani Eskola. 1986. "The Effect of Health Services on Mortality: Decline in Death Rates from Amenable and Non-amenable Causes in Finland, 1969-81." Lancet 1(8474):199-202.

_____. 1988. "Health Services Resources and their Relation to Mortality from Causes Amenable to Health Care Intervention: A Cross-National Study." International Journal of Epidemiology 17:86-89.

Pol, Louis G. and Richard K. Thomas. 1992. The Demography of Health and Health Care. New York: Plenum Press.

Preston, Samuel H. 1984. "Children and the Elderly: Divergent Paths for America's Dependents." Demography 21: 435-57.

_____. 1993. "Demographic Change in the U.S., 1970-2050." Pp. 19-71 in A. M. Rappaport and S. J. Schieber (eds.), Demography and Retirement: The Twenty-first Century. Westport: Praeger.

_____. 1996. American Longevity: Past, Present, and Future. CPR Policy Brief No. 7. Syracuse University.

Preston, Samuel H. and Irma T. Elo. 1995. "Are Educational Differences in Adult Mortality Increasing in the United States?" Journal of Aging and Health 7:476-96.

Preston, Samuel H., Irma T. Elo, Andrew Foster, Haishan Fu. 1998. "Reconstructing the Size of the African American Population by Age and Sex, 1930-1990." Demography 35:1-21.

Preston, Samuel H., Irma T. Elo, Ira Rosenwaike, and Mark Hill. 1996. "African-American Mortality at Older Ages: Results from a Matching Study." Demography 33:193-209.

Preston, Samuel H. and Michael R. Haines. 1991. Fatal Years: Child Mortality in Late Nineteenth-Century America. Princeton: Princeton University Press.

Preston, Samuel H., Patrick Heuveline, and Michel Guillot. 2000. Demography: Measuring and Modeling Population Processes. Oxford: Blackwell.

Preston, Samuel H., Mark E. Hill, and Greg L. Drevenstedt. 1998. "Childhood Conditions that Predict Survival to Advanced Ages among African Americans." Social Science and Medicine 47:1231-46.

Preston, Samuel H., Mark E. Hill, and Ira Rosenwaike. 2000. "Age Reporting and Mortality among White Americans Aged 85+: Results of a Record Linkage Study." Demography 37:175-86.

Reed, Louis S. 1965. The Extent of Health Insurance Coverage in the United States. Social Security Administration, Office of Research and Statistics, Research Report No. 10. Washington: U.S. Department of Health, Education, and Welfare.

Rice, Dorothy P. 1964. "Health Insurance Coverage of the Aged and Their Hospital Utilization in 1962: Findings of the 1963 Survey of the Aged." Social Security Bulletin 27(7):9-26.

Rice, Dorothy P., Arne Anderson, and Barbara S. Cooper. 1968. "Personal Health Care Expenditures of the Aged and Non-Aged." Social Security Bulletin 31(8):19-24.

Robert, Stephanie A. 1998. "Community-Level Socioeconomic Status Effects on Adult Health." Journal of Health and Social Behavior 39:18-37.

Rogers, Richard G. 1995. "Marriage, Sex, and Mortality." Journal of Marriage and the Family 57:515-26.

Rogers, Richard G., Jacqueline A. Carrigan, and Mary Grace Kovar. 1997. "Comparing Mortality Estimates Based on Different Administrative Records." Population Research and Policy Review 16:213-24.

Rogers, Richard G., Robert A. Hummer, Charles B. Nam, and Kimberley Peters. 1996. "Demographic, Socioeconomic, and Behavioral Factors Affecting Ethnic Mortality by Cause." Social Forces 74:1419-38.

Rogot, Eugene, Paul D. Sorlie, Norman J. Johnson, and Catherine Schmitt. 1992. A Mortality Study of 1.3 Million Persons by Demographic, Social, and Economic Factors: 1979-1985 Follow-Up. Washington: National Institutes of Health.

Rogot, Eugene, Paul D. Sorlie, and Norman J. Johnson. 1986. "Probabilistic Methods in Matching Census Samples to the National Death Index." Journal of Chronic Diseases 39:719-34.

Rutstein, David D., William Berenberg, Thomas C. Chalmers, Charles G. Child, III, Alfred P. Fishman, and Edward B. Perrin. 1976. "Measuring the Quality of Medical Care: A Clinical Method." New England Journal of Medicine 294:582-88.

SAS Institute, Inc. 1989. SAS/STAT User's Guide, Version 6, Fourth Edition, Volume 2. Cary: SAS Institute, Inc.

Schneider, Dona, Michael Greenberg, and Lisa L. Lu. 1997a. "Region of Birth and Mortality from Circulatory Diseases among Black Americans." American Journal of Public Health 87:800-04.

_____. 1997b. "Early Life Experience Linked to Diabetes Mellitus: A Study of African-American Migration." Journal of the National Medical Association 89:29-34.

Shaw, R. Paul. 1975. Migration Theory and Fact. Philadelphia: Regional Science Research Institute.

Simonato, Lorenzo, Terri Ballard, Pierantonio Bellini, and Regina Winkelmann. 1998. "Avoidable Mortality in Europe 1955-1994: A Plea for Prevention." Journal of Epidemiology and Community Health 52:624-30.

Somers, Anne R. and Herman M. Somers. 1977. Health and Health Care: Policies in Perspective. Germantown: Aspen.

Sorlie, Paul D., Eric Backlund, and Jacob B. Keller. 1995. "U.S. Mortality by Economic, Demographic, and Social Characteristics: The National Longitudinal Mortality Study." American Journal of Public Health 85:949-56.

Sorlie, Paul D., Norman J. Johnson, Eric Backlund, and Douglas D. Bradham. 1994. "Mortality in the Uninsured Compared with that in Persons with Public and Private Health Insurance" Archives of Internal Medicine 154:2409-16.

Taeuber, Karl E. and Alma F. Taeuber. 1965. Negroes in Cities. Chicago: Aldine Publishing.

Tolnay, Stewart E. 1997. "The Great Migration and Changes in the Northern Black Family, 1940 to 1990." Social Forces 75:1213-38.

_____. 1998. "Educational Selection in the Migration of Southern Blacks, 1880-1990." Social Forces 77:487-514.

Tolnay, Stewart E. and E. M. Beck. 1992. "Racial Violence and Black Migration in the American South, 1910 to 1930." American Sociological Review 57:103-16.

Tolnay, Stewart E. and Kyle D. Crowder. 1999. "Regional Origin and Family Stability in Northern Cities." American Sociological Review 64:97-112.

Tolnay, Stewart E., Kyle D. Crowder, and Robert M. Adelman. 2000. "'Narrow and Filthy Alleys of the City'?: The Residential Settlement Patterns of Black Southern Migrants to the North." Social Forces 78:989-1015.

U.S. Bureau of the Census. 1964. Census of Population: 1960. Volume I, Characteristics of the Population. Part I, United States Summary. Washington: U.S. Government Printing Office.

_____. 1974. "Estimates of the Population of the United States, by Age, Sex, and Race: April 1, 1960 to July 1, 1973." Current Population Reports Series P25, Number 519. Washington: U.S. Bureau of the Census.

_____. 1975. Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition, Part 2. Washington: U.S. Bureau of the Census.

_____. 1985. Unpublished estimates of the age-specific black and white population and migration, 1960-1980.

_____. 1992. Unpublished estimates of the age-specific black and white population and migration, 1980-1990.

_____. 1995. "Health Insurance Coverage: 1994." Current Population Reports, Series P60, Number 190. Washington: U.S. Bureau of the Census.

_____. 1996. "Health Insurance Coverage: 1995." Current Population Reports, Series P60, Number 195. Washington: U.S. Bureau of the Census.

_____. 1997a. "Health Insurance Coverage: 1996." Current Population Reports, Series P60, Number 199. Washington: U.S. Bureau of the Census.

_____. 1997b. Statistical Abstract of the United States: 1997. Washington: U.S. Government Printing Office.

_____. 1998. "Health Insurance Coverage: 1997." Current Population Reports, Series P60, Number 202. Washington: U.S. Bureau of the Census.

_____. 1999. "Health Insurance Coverage: 1998." Current Population Reports, Series P60, Number 208. Washington: U.S. Bureau of the Census.

_____. 2000. "(NP-D1-A) Projections of the Resident Population by Age, Sex, Race, and Hispanic Origin: 1999 to 2100." Abstracted from the Census Bureau's website <www.census.gov> on December 12, 2000.

U.S. Congress, Office of Technology Assessment. 1992. Does Health Insurance Make a Difference?, Background Paper. Washington: U.S. Government Printing Office.

Valkonen, Tapani. 1987. "Male Mortality from Ischaemic Heart Disease in Finland: Relation to Region of Birth and Region of Residence." European Journal of Population 3:61-83.

Ventura, Stephanie J., Joyce A. Martin, Sally C. Curtin, and T. J. Mathews. 1998. "Report of Final Natality Statistics, 1996." Monthly Vital Statistics Report Number 46, Volume 11. Hyattsville: National Center for Health Statistics.

Vladeck, Bruce C. 1999. "The Political Economy of Medicare." Health Affairs 18:22-36.

Vladeck, Bruce C. and K. M. King. 1995. "Medicare at 30: Preparing for the Future." Journal of the American Medical Association 274:259-62.

Waldron, Ingrid. 1976. "Why Do Women Live Longer than Men?" Social Science and Medicine 10:349-62.

_____. 1986. "What Do We Know About Causes of Sex Differences in Mortality? A Review of the Literature." Population Bulletin of the United Nations 18:59-76.

Westerling, Ragnar, Anders Gullberg, and Måns Rosén. 1996. "Socioeconomic Differences in 'Avoidable' Mortality in Sweden 1986-1990." International Journal of Epidemiology 25:560-67.

White, Kevin M. 1999. "Cardiovascular and Tuberculosis Mortality: The Contrasting Effects of Changes in Two Causes of Death." Population and Development Review 25:289-302.

White, Kevin M. and Samuel H. Preston. 1996. "How Many Americans Are Alive Because of Twentieth-Century Mortality Improvements?" Population and Development Review 22:415-30.

Williams, David R. 1996. "The Health of the African American Population." Pp. 404-16 in S. Pedraza and R. G. Rumbaut. Origins and Destinies: Immigration, Race, and Ethnicity in America. New York: Wadsworth.

Wilmoth, John R. 2000. The Berkeley Mortality Database. Department of Demography, University of California-Berkeley. http://boserup.qal.berkeley.edu/wilmoth/mortality.

Wingard, Deborah L. 1984. "The Sex Differential in Morbidity, Mortality, and Lifestyle." Annual Review of Public Health 5:433-58.

Wood, Evan, Anthony M. Sallar, Martin T. Schechter, and Robert S. Hogg. 1999. "Social Inequalities in Male Mortality Amenable to Medical Intervention in British Columbia." Social Science and Medicine 48:1751-58.

Woolhandler, Steffie, David U. Himmelstein, Ralph Silber, Michael Bader, Martha Harnly, and Alice A. Jones. 1985. "Medical Care and Mortality: Racial Differences in Preventable Deaths." International Journal of Health Services 15:1-11.

World Health Organization. 1977. Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Ninth Revision. Volume 1. Geneva: World Health Organization.

_____. 1992. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. Geneva: World Health Organization.

Zopf, Paul E., Jr. 1992. Mortality Patterns and Trends in the United States. Westport: Greenwood Press.

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